
W. Sherwin Sculp.

AN

INTIRE SYSTEM

OF

Arithmetic:

OR

Arithmetic in all its Parts.

CONTAINING

I. *Vulgar.*
II. *Decimal.*
III. *Duodecimal.*
IV. *Sexageſimal.*
V. *Political.*
VI. *Logarithmical.*
VII. *Lineal.*
VIII. *Inſtrumental.*
IX. *Algebraical.*

With the Arithmetic of Negatives, and Approximation or Converging Series.

The Whole intermix'd with *Rules New, Curious, and Uſeful,* moſtly Accounted for in the *PREFACE.*

The *Algebraic Part* is rendered more *Plain* and *Eaſy* than hath been done, by Inſtructive Rules and Examples *Literally* and *Numerally, in a Method New*: Solving Equations, Simple, Quadratic, Cubic, &c. ſeveral ways.

And in the proper Places of this Work are *An Accurate Table of Logarithms* to 10000, and Rules to find thoſe to 100000000, and Natural Numbers to ſuch Logarithms; with *the full Uſe of the Table* in Multiplication, Diviſion, Involution, Evolution, and in the Solution of *all Caſes of Compound Intereſt*, of which there are 24 Large and Exquiſite Tables, (and one for the Valuation of Church or College-Leaſes of their Land) as alſo thoſe of *Simple Intereſt and Diſcount*; with a new Method of finding the latter, and the preſent Worth of Money for Days.

Alſo Ample Definitions and Explanations of Numbers, Quantitys, and Terms uſed in all Parts of Arithmetic, in Alphabetical Order; rendring the Whole more Intelligible, and the Eaſier Learned.

With an APPENDIX, ſhewing the Menſuration of more Superficies and Solids, than any Book wrote purpoſely on that Subject has exhibited.

This TREATISE, for Copiouſneſs and Novelty of Matter and Method, far exceeding the moſt Perfect Arithmetic extant.

Neceſſary for all who would in a ſhort Time, and with little Study, acquire a competent Knowledge of Numbers and Species, or would make any conſiderable Progreſs in the Mathematicks.

Written by *EDWARD HATTON* Gent.

LONDON, Printed: And ſold by Mr. MOUNT and Comp. on *Tower-Hill*; Mr. STRAHAN and Mr. SIMON in *Cornhill*; Mr. KNAPLOCK, Mr. KNAPTON, and Mr. HOLLAND, in *St. Paul's Church-yard*; Mr. BROWNE, Mr. MEARS, and Mr. VALENTINE, by *Temple-Bar*; Mr. KING, in *Weſtminſter-Hall*; Mr. CLEMENTS, at *Oxford*; and Mr. CROWNFIELD, in *Cambridge*. 1721.

To the Learned

Dr. JOHN KEILL M.D.

Fellow of the Royal Society, and Professor of Astronomy in the University of Oxford.

GREATNESS and Goodness (you know, Sir) compleat the Rational Specie: By Greatness I mean true Magnanimity embelished with Learning and Science; by Goodness I suppose such a one as above, finished with an humble condescending communicative Temper or Disposition: And by how much any one excels in the former, by so much he is to be admired for the latter Endowments. I need not tell the World how much the Qualifications and Acquirements of the first kind are yours, Sir: Your Learned Treatises of Philosophy, Astronomy, *&c.* in another Language, are sufficient Indications of that: And for the other, I have experienced your Condescending, Generous, and Diffusive Goodness, not only in your giving me an Opportunity of being known to you; but by

the many Favours in ſo ſhort a time received from you: which propitious Providence having ſo ordered as to be the Conſequence of my writing the following Book, I could neither juſtly nor naturally think of Dedicating it to any but Yourſelf.

And altho I am far from having intended this Treatiſe for the few of your Superior and Univerſal Genius; yet I am not without hopes, but that upon an impartial and particular Peruſal, even ſuch as you may find ſome things Novel and Acceptable. And as for thoſe who have not, but are deſirous to acquire the Knowledge of Arts Mathematical, (a Study ſo exceeding Pleaſant and Uſeful) I have endeavoured to guide them at leaſt to the Entrance of that large and unfrequented Path in which you and ſome others of your moſt Illuſtriouſly Learned Royal Society have made ſo vaſt a Progreſs.

The Preface enumerates ſome of thoſe many Things which I take to be New, and not contained in any other Treatiſe of Arithmetic in our own Language: And for what is in others, I know you are a much better Judge than,

S I R,

Your Obliged and moſt Humble Servant,

Edw. Hatton.

TO THE

READER.

HAVING *for many Years paſt ſpent my Leiſure Hours in Mathematical Studys, and not meeting with any Treatiſe teaching in a Succinct Order, and Good Method, all the Parts of Arithmetic; and having made Emendations and Improvements in moſt, and inveſtigated and diſcovered things new in many others: I ſuppoſed the Publication thereof would be accordingly received by the Studious in this Art. But to be a little more particular, I have by way of* Introduction *inſerted* very Uſeful *and* Copious Definitions of Numbers, *and* Explications of Terms *Arithmetical, which will admit of the Whole being eaſier underſtood and ſooner learnt. I have next given the* moſt Large *and* plain Numeration-Table; *and* Tables and Rules *to aſſiſt the leſs knowing* in Addition without Pricking *and* Carrying; *and how to add Money, Weight, Meaſure,* &c. *by one Rule: Alſo* Tables *of* Weight, Meaſure, *&c. in a more accurate Method, and more various than others: The* Reaſon *of the Way of Working in* Subſtraction *and* Multiplication; *and in Multiplying by ſeveral Digits, I have given the Reaſon why the Products of all from the firſt are put one place more towards the left hand: Alſo a large Table for Beginners, and a new brief one of my own contrivance for the more Skilled. In* Diviſion *I have ſhewed* four ſeveral Ways,

Ways, *with the Reaſon of the Method of Operation, and how to find all the even Parts of any Numbers, which is applied in finding the Aliquot Parts of a Pound* Sterling, *&c. And beſides the plain and beſt Way of* Extracting the Square and Cube Roots of Numbers, *I have given Rules how to do that of the* Biquadrate *by an Example* altogether New, *and muſt be eſteemed Curious, eſpecially to thoſe who are not acquainted with Algebraic Canons. In* Progreſſion *you have ſeveral things not to be found in other Books of this Subject; as Rules to find the Total of a Series produced by different Factors, and of the Changes to be rang on any Number of Bells,* &c. *with the* Reaſon *of the* Abſtruſe Rules *for* finding the Totals of Series's, *whether the Ratio be Arithmetical or Geometrical: And have recommended this Part of Arithmetic to the Learner's Peruſal, and not to be paſſed over, as is too common both in Books and Schools. And whereas others on this Subject give but four, or at moſt five kinds of* Rules of Proportion, *I have in this Treatiſe* exhibited Twelve. *The* Rules of Practice are far more Numerous, Brief, and Methodical, *than any done by another Hand: And here are many things* more than common *in* Fellowſhip, *as three ſeveral Ways of anſwering Queſtions,* &c. *as alſo in* Alligation, Barter, *and* Equation of Payments.

In Decimal Arithmetic *(beſides the Hint given of a New Specie thereof) you have* ſo many things truly Novel and Curious, *eſpecially in Reduction and Multiplication, as would be too prolix to enumerate; where you will find ſome Anſwers exhibited by ſhort and accurate Methods quite contrary to the General Rules given for Addition and Subſtraction;* i.e. *By Adding and Subſtracting one and the ſame Number, as Units to Tens place,* &c. *and the contrary.*

And in the Uſe of Decimals, beſides the Way of anſwering any Queſtion by Decimals as exactly as by Vulgar Fractions (which to me is wholy new) you have the only Genuine Tables of Diſcount *that I know extant, with a* New *as well as more* Brief *and Eaſy Method of* Computing *both* Diſcount *and* Preſent Worth *of any Sum for Days, (ſo much practiſed by Traders) the Foundation of which you will find in* Algebra, *Chap.* 10. *I have next ſhewed the* Arithmetic of Duodecimals *and* Sexageſimals; *the former uſed in Menſuration of Superficies and Solids, the latter (chiefly) in Aſtronomy, whence called by ſome Aſtronomicals: and theſe I have done in a new plain Method, and for the more difficult Caſes. As to* Political Arithmetic, *I have ſaid enough to ſhew its Nature and Manner of Proceſs to diſcover what is required, illuſtrating the ſame by Examples, and have referred to others who have purpoſely and wholly treated thereon. In* Logarithms *I have* omitted nothing that I could find neceſſary *or deficient in other Authors; and believe I may with Veracity affirm, That no Book*

of

of Arithmetic affords ſo ample and plenary Inſtructions on that Head: And have endeavoured to render that part which has put many to a Ne plus ultra (*as being ſomewhat leſs intelligible, and not eaſily retained in Memory*) *I mean the* Addition and Subſtraction of the Logarithms of Decimals, plain *to any of a moderate Capacity; and have enlarged in a familiar way on the* Uſe of Logarithms in Multiplication, Diviſion, Involution, Evolution *or the Extraction of the Roots of all Powers; and in the* Solution of all the Caſes of Compound Intereſt: *As alſo how Operations in Vulgar Fractions are performed by* Logarithms, whereof I have given you a large Table *actually and by Inſpection to* 10000, *and made it ſubſervient for Natural Numbers, tho ſo great as* 100000000, *by help of a Table of Proportional Parts (there alſo inſerted) or without it; and have taken the elaborate Pains to write both Tables all over with my own Hand, that I might the better anſwer for their Accuracy: In doing whereof, I have corrected* 33 *Errors in one of our laſt publiſhed Tables to* 10000; *and comparing the ſame alſo with Mr.* Norwood's *3d Edition of his Trigonometry, I have rectified his in* 182 *ſeveral places: ſo that I hope mine will be found very Correct. In* Lineal Arithmetic *I have performed my* Operations three ſeveral ways, *and have ſhewed how* to make the Lines of Chords *for the Menſuration of Arks of Circles; the* Line of half Tangents *for Diameters, or thoſe Great Circles repreſented thereby in Projections of the Sphere; and the* making the Line of Numbers, *commonly called* Gunter's Line, *to any Radius from a Table of Logarithms; and this both on a right Line and on the Ambit of a Circle: which I would not omit, in regard I found many of the Inſtrument-Makers that I diſcourſed on this matter, to be ignorant of it. What I have* advanced in Inſtrumental Arithmetic, *will be found not only New and Pleaſant, but very Uſeful, particularly the new and plain Way of Working by* Neper's Bones; *but eſpecially the Uſe of my* New Circular Inſtrument *contrived by me, whereby* the Reduction of Coin, Weight, and Meaſure to Decimals, and the contrary, are ſpeedily, eaſily, and accurately performed; *not by gueſs, (as ſome Scales only have them) but actually and explicitly, as I have ſhewn by various Examples. And Multiplication, Diviſion, and Extraction of Roots,* &c. *may be done by the two Lines of Numbers made to turn round one within the other, and are placed next the Limb or Edge of the Inſtrument, the Dimenſion whereof being ſo large as* 33 *Inches, I doubt not but it will be allow'd as the beſt and moſt Compleat extant for all Arithmetical Uſes. In* Algebra *I have previouſly given many* more Numerous and Uſeful Definitions *relating to this Analytical Art, than any Treatiſe of Arithmetic affords; and have throughout that profound Science illuſtrated the Nature and* demonſtrated the Truth of the Symbolical Operations

tions by Numeral Examples, *intermixing ſeveral things New, and my own Invention: particularly the Way of finding* the Unciæ of Powers *to the* 15*th, and the Powers of a Binomial to the* 10*th, as alſo the* Uncia of any Term or Member of any Power *without the Knowledge of thoſe of any previous Power. I have alſo ſhewed the* Reaſon of the Proceſs in Extracting the Roots *from the reſpective Powers of a Binomial; and have likewiſe made the* Algorithm of Surds *very perſpicuous by Examples in* Numbers as well as Species, *and have done the like in all the Rules of Algebra; and I have ſhewed not only the* Solution of Simple Equations *and thoſe by* various Poſitions, *but* Quadratical *and* Cubical, *each three different ways: In all which, as well as in* Approximation or Converging Series, *I have purpoſely deſigned to render the* Manner of Solution intelligible *to a mean Capacity, that being the principal thing in which the Learned Authors on this Subject have been deficient.* The Arithmetic of Negatives *I have fully accounted for, as will appear if to what is ſaid under* [Negative Arithmetic] *in the Alphabetical Explanation at the beginning of Algebra, you add what is in* Sect. 3. *of* Chap. 7. *in* Sect. 2, 3, 4, 5. *of* Chap. 10. *and under the laſt of my Examples of Converging Series, near the Cloſe of this Treatiſe.*

But notwithſtanding the particular Regard of my former Labours, and eſpecially of this, to promote a ſort of Learning ſo Uſeful to the Public; yet ſo numerous are the captious and prejudiced Readers of this our envious Age, that it would be Vanity in me to hope to eſcape their Cenſures. But if my Endeavours prove acceptable to the two Claſſes of Readers for whom they were chiefly intended, i. e. *the Candid and Induſtrious Teacher and the Diligent and Studious Learner; I ſhall eſteem it a good Step towards an ample Compenſation for the uncommon Care and Trouble of this Performance thus dedicated to the Service of the Public; and ſhall the leſs regard the Carps and raſh Judications of pragmatical and ungrateful Diſpoſitions, who fancy there is nothing in Arithmetic beyond what they have acquired the Knowledge of: or if they learn any thing from a Book of this kind, will be the laſt in paying their Acknowledgment, and probably the firſt in decrying the Work, becauſe it will inſtruct ſome to know more than they would have them, or (as we ſay) make others as wiſe as themſelves. However, I would not be diſcouraged by the ill Conduct of ſuch from imitating the moſt Perfect and Benign Pattern, who is kind to the Unthankful and the Evil: for whatever ſome Authors may have propoſed in being ſo, I have diſcloſed my Thoughts this way, much more to promote the Proficiency of the Reader, than to indicate the Science of the Author.*

And for the Encouragement of the Impartial and Ingenuous Student, who laying aſide Pride and Prejudice, deſigns only Improvement in the Knowledge of

of what is contained in the ſubſequent Pages, I can aſſure him, that I hav faithfully adapted this Work to the Capacity of the leſs Acute, and hav offered to his Peruſal many things which he will not find elſewhere; of which I have given ſome Inſtances, as above, though you have many more mentioned in the Index, which will be found Exuperation.

I have not in this Treatiſe (as is common where there are many Parts of Mathematicks, &c. in one Volume) only touched on each kind; for you will find Vulgar Arithmetic, Decimals, Logarithms, *and* Algebra, *as* copiouſly inſiſted on, *as in almoſt any Treatiſe wrote only upon ſome one of thoſe Species: Nor can any thing be expected to make the whole more truly agreeable to the Title, which is a piece of Juſtice that all Authors owe to the Publick, and cannot be denied but to have been fully obſerved by me, as I am not without Vouchers from good Hands, to confirm the Truth of, eſpecially in my* Merchant's Magazine, *and my* Index to Intereſt.

And for the Satisfaction of ſuch as are cautious of buying the firſt Impreſſion of a Book, becauſe, ſay they, *there may be Additions to future Impreſſions; I do hereby promiſe, that as I know of no Neceſſity for it, ſo I have no thoughts of doing any thing farther on this Subject.*

I have, beſides what I promiſed in my Propoſal to Subſcribers, added an Appendix, which contains the beſt Way of meaſuring a greater Variety of Superficies and Solids, than any Book, though wrote purpoſely on that Subject, exhibits.

In fine, I am ſo ſenſible of the Care and Aſſiduity uſed to finiſh this Body of Arithmetic, ſo as to render it in ſome degree Compleat, *that I hope I need not doubt of its being acceptable to the World; which hath already favoured me, by a kind Reception of my former Endeavours in this Way, although I had not beſtowed near that Thought, which (in Gratitude) I have done on this Work, in order to preſent it, as near as I could, in Perfection.*

For beſides all that is aboveſaid, I have not only compriſed in this Treatiſe, the moſt material Tables, and other things in my Index to Intereſt, (which ſhall never be but here re-printed) but have added Tables of Simple Intereſt at 4 per Cent. *of Diſcount at* 4 *and* 5 per Cent. *and* 16 *Tables of Compound Intereſt at* 3, 4, 5, *and* 8 per Cent. *And the ſaid Index (before the making theſe conſiderable Additions to it) was approved of, and recommended as the moſt copious, eaſy, and uſeful Book that hath been written on that Subject, by the judicious Perſons following; beſides many others, as I have their own Hands by me to demonſtrate.*

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Sir W. Chapman *Bar.*
Sir Samuel Clarke,
Sir John Blunt *Bar.*
} *then Directors* } *of the* South-Sea *Company.*

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Mr. Benjamin Zouch.

A N

AN INDEX to this *BOOK*;

Referring to the Pages, Chapters, and Sections, which are placed on each Folio.

In

Proportion,

The

ERRATA.

On the Title Page of the Table of *Logarithms*, after not *exceeding* 10000, add, *or* 4 *Places*. Page 176. Line ult. for *Numbers*, read *Number*. Page 8. near the Bottom, for *Sq. Biquadrat*, read *Squared Surfolid*. Page 359. After *Example* 1. read *What are the real Roots of this three Dimension (or Cubical) Equation.*

THE

INTRODUCTION:

Containing an Alphabetical Definition of all kind of Numbers, and the Terms of Art used in Common Arithmetic explained; which the Reader may have recourse to, as he finds occasion.

(Note, *That the like for Algebra is inserted immediately before that Species of Arithmetic.*) Vid. *Sect.* 1. of *Chap.* X.

Abundant Numbers,] Are such as having their Aliquot Parts added together, the Sum exceeds the Numbers of which they are Parts: as 36 is an abundant Number, because its Aliquot Parts, 1, 2, 3, 4, 6, 9, 12, 18, added, make 55, which is more than the 36.

Abstract Numbers.] Such Numbers in general, as have no Denomination annexed to them.

Absolute Numbers.] Such in reality as they appear to be, as 2, *&c.* is 2 Units contrary to 2 less than nothing (as in Algebra is explained) and to negative Indices of Logarithms: also it is that known Number in an Equation, which solely possesseth one side. See *Algebra*.

Aliquot Parts,] Are the even Parts of any Number, when there is no Remainer in the Division. See at the End of *Division*.

Aliquant Parts.] Such as will not divide another Number aſſign'd without a Surplus or Reſt: as 7 is an aliquant Part of 18 or 23, *&c.*

Amiable Numbers,] Are 2 ſuch, as that the Sum of the Aliquot Parts of one, will make up the other Number alternately.

Arithmetical Complement.] See *Sect.* 4. of *Chap.* 7. and *Complement* under C.

Arithmetical Progreſſion.] See *Progreſſion*, Chap. 2. Sect. 2.

Articles,] In this Science, are Numbers diviſible by 10 without Remainer; as 10, 20, 30, 100, 120, 130, *&c.* 2000, 4000, *&c.* the ſame with round Numbers or Decades.

Artificial Numbers,] Are Logarithms. See *Chap.* 7.

Antecedent Numbers.] The firſt named of two that are compared together: As if it be ſaid that ſome Numbers are in proportion as 3 is to 7; here 3 is the Antecedent, and 7 the Conſequent.

Binarys.] Two Places of any Number, (as pointed for the Square Root.)

Biquadrate.] See *Powers* under *P.*

Broken Numbers.] Such as are commonly called Fractions, which ſee.

Central Numbers.] Such as have a Digit placed in the middle between a like Number of Reverſe, Circulating, *&c.* Numbers, as 3457345, 12521, 78678, *&c.*

Characteriſtic] Of any Logarithm, is the Index. See *Chap.* 7.

Circular Numbers,] Are ſuch as being ſquared, cubed, *&c.* the Figure in Units place of the Power, is the ſame with that of the Root; as 6 times 6 is 36, 5 times 5 is 25, *&c.* which are ſometimes called Spherical Numbers.

Circulating Numbers,] According to ſome, are thoſe Digits which are regularly repeated, whether the Number be of one and the ſame Digit repeated, as 222, 7777, *&c.* or of many, as 494949, 372372, *&c.* And when theſe fall out in reducing Money, Weight, Meaſure, *&c.* to Decimals, you gain many Decimal Places with the leſs trouble.

Commenſurate Numbers.] Such as one Number will juſtly meaſure; as 6 and 15 are meaſured by 3, *&c.* And the Fraction $\frac{2}{5}$ is of like Value with $\frac{6}{15}$, becauſe the Terms are commenſurate by 3.

Compleat Numbers.] See *Perfect Numbers.*

Complement-Arithmetical,] Is the Remainer when any Logarithm is deducted from 10.

Compoſed Numbers.] The ſame as Compoſit Numbers; which ſee.

Compound Fractions.] Fractions of Fractions, as $\frac{1}{3}$ of $\frac{2}{7}$, *&c.* See *Chap.* 2. *Sect.* 1.

Compoſit

Compoſit Numbers.] Such as are meaſured by ſome other beſides a Unit; as 297 is compoſed of 99 by 3, either of which meaſures 297.

Common Multiples.] See *Multiples* following.

Conſequent Numbers.] The ſecond of any two in a proportion. See *Antecedent.*

Concrete Numbers.] The ſame as Contract Numbers.

Contract Numbers.] Such as have a Denomination annexed, as 5 *Lib.* 7 Yards, *&c.*

Cube Numbers.] The Product of Square Numbers by their Roots; as 8 is the Cube of 2, 27 of 3, being Products of 4 by 2, and of 9 by 3.

Cubed Square and *Cubed Cube Numbers.*] See *Powers* under *P.*

Cube-Root.] See *Roots* under *R.*

Decimal Fractions.] Thoſe whoſe Denominators are 10, or ſome Power of 10.

Decades.] The ſame with Articles, as above.

Deficient Numbers.] Thoſe whoſe Aliquot Parts (added together) are leſs than the Numbers of which they are Parts; as 26 is a deficient Number, becauſe its Parts 1, 2, and 13, make but 16.

Differences, or Common Differences, as relating to Logarithms.] See the 3d and 4th general Heads under Sect. 4. of Chap. 7.

Digits,] In Arithmetic are Numbers of 1 Place, as 1 to 9 inclusive.

Dividends.] Numbers which are to be divided. See *Diviſion,* Sect. 5. Chap. 1.

Diviſors.] Numbers of Parts into which another Number is to be divided. See *Chap.* 1. *Sect.* 5.

Dividual.] Separable or Diviſible. Alſo that Part of a Dividend which is immediately under your Operation.

Diminutive Numbers,] Are the ſame as Deficient Numbers, which are explained above.

D.] From *Denarius* (a Penny:) The Mark put over a Column of Pence in Books of Accounts.

Foot. Inch. 12ths

Duodecimals.] Fractions whoſe Denominators are 12, as 7 : 9 : 7 is 7 foot, 9 inches, (or 9 twelfths of a foot) and 7 twelfths of an inch, *&c.* Which are often marked by Meaſurers thus;

F. I. II. E. I. II. III.

7 : 9 : 7; and 48 : 11 : 3 : 10; and read the firſt, 7 foot, 9 primes, and 7 ſeconds; the ſecond is 48 foot, 11 primes, 3 ſeconds, and 10 thirds. See *Operations* thereby, *Chap.* 4.

Duplicate, Triplicate, Seſquiplicate, &c. Proportion.] See *Sect.* 3. of *Chap.* 2.

Equimultiples.] See *Multiples.*

Evenly even Numbers,] Are thoſe which even Numbers will meaſure by other even ones; as 48 is meaſured by 8, 6 times.

Evenly odd Numbers,] Are thoſe which even Numbers meaſure by odd ones; as 40, which 8 doth meaſure by 5.

Exponents,] Are Numbers (ſmaller Characters than thoſe they ſtand next) which are placed near the upper part of a Root toward the right-hand, and ſhew what Power of that Root is expreſſed; as 3^2 is the Square of 3 or 9; 3^4 is the Biquadrate of 3 or 81. Alſo 4^3 is the third Power or Cube of 4, which is 64; the Exponents being 2, 4, and 3, ſtanding higher than the others or Roots. So likewiſe 15^5 is the Surſolid or fifth Power of 15; 7^6 is the ſquared Cube or ſixth Power of 7; 20^7 is the ſecond Surſolid or ſeventh Power of 20, which is 1280000000. See *Powers* here and in Algebra.

Excluſions.] Such Numbers in a Queſtion, as being excluded, renders it leſs perplexed and the eaſier reſolved; as might be ſhewn by ſeveral Examples,

Factors.] Both the Numbers, which for the moſt part in Multiplication are called the Multiplicand and Multiplicator, (or Multiplier.)

Figuræ Numbers.] Such as do repreſent ſome Geometrical Figure, either Superficial or Solid. See thoſe Numbers and Linear.

Fractions.] Any Part or Number of Parts of a Unit *ad infinitum*: as $\frac{2}{3}$ is Vulgar; $\frac{1}{10}$, *&c.* Decimal; and $\frac{5}{12}$, *&c.* Duodecimal. See *Chap.* 2, 3. and *Sect.* 10. of *Chap.* 3.

Geometrical Progreſſion.] See *Progreſſion.*

Harmonical Proportionals.] See *Muſical,* and *Chap.* 2. *Sect.* 3. *Head* 11.

Homogeneal Numbers,] Or Homogeneous, are thoſe of the ſame nature; as the Indices of 2 Logarithms, if they are both affirmative, (without a Mark under) are Homogeneous; or they are ſo, if they are both negative, or have a Mark under thus, $\underline{3}$ and $\underline{2}$, *&c.*

Homologous.] Numbers or Terms in a proportion are ſaid to be Homologous, when there is a Similitude between the Antecedents and Conſequents; for as 3 to 9, ſo 7. 21: here 3 is homologous to 7, as 9 to 21.

Hetero-

Heterogeneal Numbers.] Thoſe which are not of the ſame kind; as when one is negative, the other affirmative, as 3 and $\bar{2}$, contrary to homogeneal. Alſo mix'd Numbers, compoſed of a Whole and a Fraction, as $2\frac{1}{3}$: and in Surds, they are ſuch as have different Radical Signs, as $\sqrt{3}$ and $\sqrt{4}$. Vid. *Algebra*, Chap. 10.

Improper Fractions.] Such whoſe Numerator is equal to or exceeds the Denominator. See *Chap.* 2.

Incommenſurate Numbers.] Two ſuch, as no one Number (except a Unit) will meaſure, contrary to commenſurate; as 7 and 23, *&c.* cannot be meaſured by any one Number.

Indices.] Numbers which ſhew the Power of a Root; and in Logarithms they ſhew the Number of Places which the natural Numbers belonging to any Logarithm conſiſts of, being the ſame with Characteriſticks. See *Exponents*, and alſo *Chap.* 4.

Ineffable Numbers,] Are Surds, or irrational Numbers; which laſt ſee: Or (according to the Import of the Word) Numbers not to be expreſſed.

Incompoſits.] Numbers which no other but a Unit will meaſure, being contrary to Compoſit, and are the ſame with prime Numbers, as 7, 11, 23, 29, 31, and hundreds more.

Intire or whole Numbers.] Any Number of Units or Ones; (but Fractions are one or more Parts of a Unit) ſo that *one* is the middle between infinite Units and infinite Parts: and tho' it is by ſome not allowed to be a Number, yet ſince it is the Foundation of all Numbers, whether whole or broken, (for 2, 3, 4, *&c.* are ſo many *ones*, and $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, *&c.* are ſo many Parts of one) and ſince 1 is as properly half the Number of things which are but 2 in all, as 2 is half the Number which are four in all; it follows, that ſince 1 is not a Fraction, (or Part of 1, which would be a Contradiction to affirm) it muſt be a Whole, *i. e.* a whole Unit, or the Number 1, as properly as 2 is 2 Units, or the Number 2, 3 the Number 3, 4 the Number 4, *&c.* For Unity is as properly an Individual (or inſeparable from Number) as theſe or any other. And if we take a Series of Numbers, as 1, 2, 3, 4, 5, here 1 in all reſpects is a Number according to its Nature, as any of the other are agreeable to the ſame common Nature of Number, and 1 is one Term or Place in that Rank as well as the others: and if the five Digits be made one Number, as 12345, 1 is here 1 ten thouſand, which is far from being no Number. It's true, 1 does not divide nor multiply, becauſe it would be abſurd to ſay that a Man had

had 1 Pound, Yard, Ounce, or the like, divided between himself; or that because I say, 1 Horse, 1 Field, &c. I should exclude the Number 1, because it does not make more or less than that Horse or Field, and so be contrary to the common Nature of all other Numbers. And as it multiplies and divides as much as it ought to do, making every thing once itself, and giving the Whole to one Person where no one is to have a share with him; so in Addition, &c. it does as all other Numbers do, *i.e.* augments or diminishes any other Number so much as itself amounts to: For if I add 1 to 5, it makes 6; that is, so much more than 5, as is the Number 1 added; as 2 added to 5, makes 7, which is itself (or N° 2.) more than the 5, &c. And whereas some great Men, as *Euclid*, &c. have defined Number to be a Multitude of Units; it is highly probable they meant no more than this, That as Unity is but 1, and there are Millions of Millions, nay, infinite other Numbers; therefore, say they, that Number (in the general way of speaking, or for the most part without comparison) is a Multitude or Aggregate of Units.

Integers,] Are whole Numbers, compared with their Parts; as 1 Penny is an Integer composed of 4 Farthings, its Parts into which it is divided; 1 Shilling is an Integer compared to Pence or Farthings, of which it is composed. But an absolute Integer is a Unit of the highest Denomination of any Specie of Matter or Thing: as 1 Pound *Sterling*, &c. 1 Ton, 1 Circle, &c. and 2, 3, &c. of the like, are so many absolute Integers.

Irrational Numbers, or *Surds*,] Are such whose Roots cannot be accurately extracted, as being no Figurate Numbers: But then they are to be considered as Surds or otherways, when compared with the Power they are of. Thus 16 is a Surd, or irrational Number, if supposed the 3d Power of some other; but if you suppose it only the 2d Power, it is not Surd, but compleatly the Square of 4: and the like may be observed of others. And when we meet with Surd Numbers, (or those that are Rational, which are to be wrought with Surds) we mark them thus, $\sqrt[2]{7}$, $\sqrt{7}$ is the way of expressing the Square Root of 7; $\sqrt[3]{27}$ is the Expression of the Cube Root of 27, which is equal to 3, &c. But more of this under *Powers*, &c. in the Algebraic Part.

Lib. or *L.* (from *Libra* a Pound-weight, or 20 *s.*) The Mark put over a Column of Pounds.

Lineal

Lineal (or *Linear*) *Numbers.*] Such as represent or are the Dimensions of a Line, Root, or Side of a Geometrical Figure. Thus if a Figure be an exact (or Geometrical) Square, containing 100 Foot, 100 is the Superficial Number, and the Side or Linear Number is 10: If it be a long Square (or Parallelogram) of the Content of 40 Yards, the Linear Numbers (or Sides) are 4 and 10, or 8 and 5.

Lineal Arithmetic,] Is that Science performed by Lines.

Logarithms,] Are Artificial Numbers, of great use in Mathematicks; the Invention of Lord *Neper*, Baron of *Merchiston*. See *Chap.* 7.

Mixt Numbers.] Whole Numbers and Fractions, (Vulgar or Decimal) which are placed together: as $13\frac{7}{8}$, 29.75, &c. Or any Number composed of Digits, or Digits and Cyphers that are not next the right-hand.

Multiples.] Are Numbers produced by the Multiplication of some known or assign'd Number: as 40 is a Multiple of 8 or 5, because either of those will divide 40 without Remainer, and 20 is a Multiple of 4 and 5.

Multiples, or *Equimultiples,*] Are Numbers multiplied by one and the same Number: as 12 and 28 are Equimultiples of 3 and 7, for 12. 28 : : 3.7.

Multiples, or *Common Multiples,*] Are when one and the same Number is produced by different aliquot Parts: as 40 is a common Multiple of 2, 4, and 5, because any of these divide it without Remainer, and because these multiplied one in another produce 40.

Multiplicator.] The same as Multiplyer. See *Chap.* 1. *Sect.* 4.

Musical Proportionals.] The same as Harmonical. See *Chap.* 2. *Sect.* 3. *Head* 11.

Negative Arithmetic.] See (*N*) near the beginning of Algebra, in which this kind is chiefly used.

Numerator of a Fraction.] The Number of Parts contained in it. See *Chap.* 2.

Ob. (from *Obolus* a Halfpenny) The Mark put for two Farthings in old Writings.

Perfect Numbers.] Those which are equal to the Sum of their aliquot Parts; as 28 is equal to the Sum of its Parts 1, 2, 4, 7, 14, which is 28; and 1, 2, and 3, are 6.

Parts Proportional.] See 3d and 4th General Heads, *Sect.* 4. of *Chap.* 7.

Plain Numbers,] Are those which may be produced by multiplying some Number in another, as 6 the Product of 3 by 2, 8 the Product

duct of 4 by 2, &c. (but 7, 11, 13, &c. are no ſuch.) Theſe are the ſame with ſuperficial Numbers, becauſe the Content of a plain ſuperficial Figure is produced by multiplying two Numbers, which are ſuppoſed its Length and Breadth together.

Poſitive Numbers.] The ſame with Affirmative. See *Abſolute Numbers*, above.

Powers of Numbers,] Are the Root or firſt Power; the Square or ſecond Power, produced by multiplying the Root in itſelf, &c. as follows.

	Roots, or 1ſt Power.	Square, or 2d Power.	Cube, or 3d Power.	Biquadrate, or 4th Power.	Surſolid, or 5th Power.	Squared Cube, or 6th Power.	The ſecond Surſolid, or 7th Power.	The Squared Biquadrate, or 8th Power.	Cubed Cube, or 9th Power.	Squared Surſolid, or 10th Power.
1ſt Example	2	4	8	16	32	64	128	256	512	1024
2d Example	3	9	27	81	243	729	2187	6561	19683	59049

Each Power being produced by multiplying the next before it towards the left-hand by the Root:

And that theſe Terms of the Powers are really what they are called; if the 5th Power or Surſolid (in the 1ſt Example 32, in the 2d 243) be ſquared or multiplied in itſelf, it produces the ſquared Biquadrate or 10th Power, for 32 by 32 gives 1024; or 243 by itſelf makes 59049. And the like may be obſerved of the reſt: for a more full Account of which, ſee the Word *Powers* in the beginning of Algebra, *Chap.* 7.

Promiſcuous Numbers.] Compoſed of Digits without any limited Order, as 7291, 3924, and thouſands of others, as under *Mixt Numbers.*

Proper

Proper Fractions.] See *Chap.* 2. *Sect.* 1.
Proportion.] See *Subduple, Subtriple, Submultiple*; and *Sect.* 3. *Chap.* 2. It is marked with Points thus, 3. 4 : : 6. 8. if direct.
Prime Numbers.] Such as no other but Unity will justly divide. See *Incompofits.*
Proportional Parts.] See *Parts Proportional.*
Progreſſion.] Numbers in Arithmetical and Geometrical Progreſſion. See *Chap.* 2. *Sect.* 2.
Q. (from *Quadrans* a Farthing) the Mark put over a Column of Farthings.
Quotient.] See *Diviſion*, Sect. 5. Chap. 1.
Roots of Numbers.] The firſt Powers. See *Powers* above, and *Linear* N°.
Ratio,] Is the Reaſon or Proportion that one Number bears to another. Or more particularly it is Direct, Simple Ratio, Duplicate Ratio, Triplicate, *&c.* See *Chap.* 2. *Sect.* 3. Or Ratio in Progreſſion is the Rate by which the Terms increaſe or decreaſe.
Rectangle.] The ſame as Product, which is the Sum produced by multiplying 2 together; as 2 times 4 is 8 = the Product or Rectangle.
Reverting Numbers.] Such as are compoſed of a like Number of ſucceſſive Digits aſcending and deſcending, as 345543, 7887, &c.
Round Numbers.] The ſame with Articles and Decades, which ſee.
Seſquiplicate Proportion.] See *Head* 12. of Sect. 3. of Chap. 2.
Similar Numbers,] Are either, 1ſt, Plain, which are ſuch as form like or ſimilar plain Figures; as a Plain of 21 formed by the Rectangle of 7 by 3, is ſimilar to another of 84 formed by the Sides or linear Numbers 14 and 6; for as 6 to 14, ſo 3 to 7. Or, 2dly, Similar ſolid Numbers are ſuch as form like or ſimilar Solids (as Parallelopipedons, or 2 or 3 Dyes joined to the end of each other) of different, but proportionable Dimenſions.
S. (i.e. *Solidus*) the Mark placed over Shillings in a Column of Money.
Spheric Numbers.] The ſame with Circular Numbers, which ſee.
Subduple Proportion.] Numbers are in ſubduple Ratio, when the Antecedent contains the Conſequent (or the contrary) twice; as 5 to 10, or 40 to 20, and the like.
Subtriple.] Numbers are in a ſubtriple Proportion, when the Conſequent is 3 times the Antecedent, or the contrary; as 9 to 27, or 90 to 30, &c.
Submultiple.] Numbers are in a ſubmultiple Ratio, when the Conſequent contains the Antecedent, or the contrary, above three times without Remainer.

Square Numbers.] All such as are produced by multiplying any Number by itself, because that Product represents a Figure of four equal Sides.

Surd Numbers.] The same with Irrational, which see.

Sexagesimal Numbers,] Are such Fractions as have 60 for their Denominator, used in measuring Time, and the Motion of the Celestial Spheres, Geography and Navigation: But they put not down the Denominator in these, no more than in Duodecimals, because it never alters, being always 60, as those are 12. Thus

0 I II III IIII IIIII

51 : 30 : 45 : 17 : : 1 : 59 are read 51 Degrees, 30 Minutes, (or 60th Parts of a Degree) 45 Seconds, (or 60th Parts of a Minute) 17 Thirds, (or 60th Parts of a Second) 21 Fourths, (or 60th Parts of a Third) and 59 Fifths, or 60th Parts of a Fourth, *&c.*

Of Operations in this kind of Fraction, the Work of Addition is easy: Adding up a Column of Minutes, Seconds, *&c.* and dividing by 60, putting the Remainer under the Line, and carrying the Quote to the next Column toward the left hand, *&c.* borrowing 60 always in Substraction. And for multiplying Degrees, Minutes, Seconds, Thirds, *&c.* these may be done decimally, by reducing the lower Denominations into the Decimal of the highest, and then working as is shewed in Decimals, Chap. 3. And by the same Rule and Division of Decimals, is the best way to divide these. But see *Chap.* 5.

Successive Numbers.] Such as are composed of Digits which stand in a natural Succession ascending and descending, as 34567, or 9876.

Tabular Numbers.] Such as are found in Tables, as of Logarithms, Interest, *&c.*

Tarif Numbers.] The same as Tabular Numbers. But the Term is most used in Tables of Customs, and Series of a Divisor by the 9 Digits.

Terms.] The two Parts of a Vulgar Fraction are call'd its Terms; and so are the several distinct Numbers in an Arithmetical and Geometrical Progression.

Ternary Numbers.] Such as have 3 places: Or even 3 places of any Number are so many Ternarys, as used in extracting the Cube Root.

Triplicate Proportion.] See *Proportion,* or *Sect.* 3. of *Chap.* 2. *Head* 10.

Unit, or *Unity.*] The Number 1. See *Intire Numbers,* above.

Unevenly odd Numbers.] Those odd Numbers produced by the Multiplication of 2 odd Numbers together; as 63, which is 7 times 9; 45, which is 9 times 5, &c.

CHAP.

CHAP. I.

Treateth of the ſeveral Parts of ſingle Arithmetic (called Common Arithmetic in whole Numbers) containing Numeration, Addition, Subſtraction, Multiplication, Diviſion, and the Extraction of Roots, which are called Simple or Single Rules of Arithmetic, as being Fundamental Parts or Principles, by one or more of which, all Operations by Numbers are performed.

SECT. I. *Of Numeration of Intire Numbers.*

BY this firſt Part we are taught how to read or write down any Number propoſed, by aſſigning a proper and natural Denomination for the Place of each Digit in any Line, (tho compoſed of never ſo many of thoſe Digits) and then by obſerving what Digit is there placed.

By a Digit we underſtand any ſingle Figure poſſeſſing but one place, as 1 to 9 incluſive.

There is alſo a Cypher, (or o) which ſtanding alone, or next the left hand of any ſingle Figure or Number of Figures in whole Numbers, is of no value; it only ſerving to fill up places, in order to augment the value of the ſimple Figure or Figures, which are placed to the left hand thereof; which places might as well be ſupplied by a Point (.) or Hyphen (-) thus, if that had obtained a Cuſtom, as the (o) hath.

By what is ſaid it appears, that after we know the Character of the 9 Digits, (which almoſt every Child learneth ſo ſoon as it can read) there is nothing remains to make one able to read any Num-

ber, but to consider by what Name the several Places in any Number or Rank of Digits is called: and that will appear, by what follows, very obvious.

The Denomination of each particular Place of any Number not exceeding 9 Places, or that of Hundreds of Millions.

Examples how the Course or Order of the Places augments toward the left hand infinitely.

How each of the 9 Numbers are to be read in one Line or Number.

	9th place.	8th place.	7th place.	6th place.	5th place.	4th place.	3d place.	2d place.	1st place.	
One Hundred Millions	1	0	0	0	0	0	0	0	0	One Hund. and 11 Mill.
Ten Millions ——		1	0	0	0	0	0	0	0	
One Million ——			1	0	0	0	0	0	0	
One Hundred Thousand				1	0	0	0	0	0	One Hund. and 11 Thous.
Ten Thousand ——					1	0	0	0	0	
One Thousand ——						1	0	0	0	
An Hundred ——							1	0	0	
Ten —— ——								1	0	
One —— ——									1	One Hund. and Eleven.
Two Hundred Millions	2	0	0	0	0	0	0	0	0	2 Hund. Milli.
Twenty Millions ——		2	0	0	0	0	0	0	0	20
Two Millions ——			2	0	0	0	0	0	0	2
Two Hundr. Thousand				2	0	0	0	0	0	2 Hund. Thous.
Twenty Thousand——					2	0	0	0	0	20
Two Thousand ——						2	0	0	0	2
Two Hundred ——							2	0	0	2 Hund. Units.
Twenty —— ——								2	0	20
Two —— ——									2	2
Three Hundr. Millions	3	0	0	0	0	0	0	0	0	3 Hund. Milli.
Thirty Millions ——		3	0	0	0	0	0	0	0	30
Three Millions ——			3	0	0	0	0	0	0	3
Three Hundr. Thousand				3	0	0	0	0	0	3 Hund. Thous.
Thirty Thousand ——					3	0	0	0	0	30
Three Thousand——						3	0	0	0	3
Three Hundred ——							3	0	0	3 Hund. Units.
Thirty —— ——								3	0	30
Three —— —— ——									3	3

From

From the Scheme above it may be obſerved, *viz.* 1*ſt*, From the middle Column it is plain that every place towards the left hand in any Number is 10 times the Value or Number of the place next it towards the right hand; as 1, 2, or 3, in the 2d, 3d, or 4th places becomes 10, 100, 1000; 20, 200, 2000; and 30, 300, 3000, &c.

2*dly*, The Column next the left hand gives you the Name that any Number in any place (not exceeding the 9th) is to be called by: As the firſt or uppermoſt in each of the three Examples above, is the Hundreds of Millions place; and conſequently the Numbers are in Value 1, 2, and 3 hundred Millions, becauſe the Digits there placed are 1, 2, and 3. But inſtead thereof, if 4, 5, 6, *&c.* were put in thoſe places, the Numbers muſt be 4 hundred Millions, 5 hundred Millions, or 6 hundred Millions, *&c.* the Value or Name depending on the place that any Digit poſſeſſeth in any Number.

3*dly*, From the third Column it is evident, that in reading a Number there is a Contraction or Abbreviation of the Words in the firſt Column to be uſed. Thus (in the third Example) we do not read the three firſt Lines 3 hundred Millions, 30 Millions, and 3 Millions; but do only name the word Millions after the laſt of the three Figures. Thus 3 hundred thirty three Millions, and ſo of the Thouſands, we ſay 3 hundred thirty three Thouſand, *&c.* 333.

By theſe Rules, any Number, tho never ſo great, may be read, as is farther exemplified by the following Table of this Art of Numbering; which is much more copious and ample, than any Arithmetic that I know of exhibits.

The

The Numeration TABLE.

Number of Lines reckoned upward.	5	4	3	2	1	Places each Number or Line of Figures consisteth of.
36	1	23456789	876543234	56789876	543234567	Hundred of M.
	2	907600043	000013257	321000000	732124371	X of Thousand
35		3	100000042	320304432	200000032	Thousands
34		2	000007234	000340000	040000057	Hundreds
33		3	400000234	500004255	500000321	Tens
32		4	560000321	570000421	652134563	Units
31		3	210000401	350040600	012350100	Hundr. of Thouf.
30		4	230000043	217643210	023400291	X of Thousand
29		2	123456789	000000000	012345678	Thousands
28		3	212345678	000000000	012345678	Hundreds
27		4	321234567	000000000	012345678	Tens
26		5	432123456	000000000	012345678	Units
25		6	543212345	000000000	012345678	Hundr. of Thouf.
24		7	654321234	500000000	012345678	Tens of Thouf.
23		8	765432123	450000000	012345678	Thousands
22		9	876543212	345000000	012345678	Hundreds
21		1	234567891	000000000	012345678	Tens
20		2	345678900	230000000	000000000	Units
19		1	234567891	000000000	012345678	Hundr. of Thouf.
18		2	345678900	230000000	000000000	Tens of Thouf.
17		3	000045678	934000021	123456789	Thousands
16		4	000056789	234500432	123456789	Hundreds
15		5	000067891	234543314	123456789	Tens
14		6	000078901	234364134	123456789	Units
13		7	000089001	234456789	012345678	Hundr. of Thouf.
12		8	000090001	234611234	567890123	Tens of Thouf.
11		9	000087654	321123456	789012345	Thousands
10		1	234567891	000000000	012345678	Hundreds
9		2	345678900	230000000	000000000	Tens
8		3	000045678	934000021	123456789	Units
7		4	000056789	234500432	123456789	Hundreds of Thouſands.
6		5	000067891	234543314	123456789	Tens of Thouſands.
5		6	000078901	234364134	123456789	Thouſands.
4		7	000089001	234456789	012345678	Hundreds.
3		8	000091234	611234567	890123456	Tens.
2		9	876543212	345678901	234567890	Units.
1		4	321123456	789012345	678901234	

Quinquillions. Quartillions. Trillions. Billions. Millions.

1. It may not be improper to inform the Reader, that we make uſe of the words Billions, Trillions, *&c.* to prevent the Confuſion that would ariſe by the often repeating Millions of Millions, *&c.* And if it be enquired how much a Trillion (or the like) is; I look for the Units of Trillions at the top of the Table, and caſting my Eye downward in that Line till I come to the lower end of it, I then look directly toward the left hand, and find it a Number conſiſting of 19 places, *viz.* 18 Cyphers and (1) next the left hand in the 19th place, and is found by involving (or multiplying) a Million in itſelf, and that Product by a Million. So that a Trillion is as much as to ſay, one Million of Millions of Millions. So likewiſe a Quartillion is 1000000 multiplied three times in itſelf, (called its Biquadrate) and conſiſts of 25 places: A Quinquillion is 1000000 multiplied 4 times in itſelf, and conſiſts of 31 places, (called the Surſolid or fifth Power of 1000000, of which Powers I ſhall ſpeak in a proper place) All which appears plain by the foregoing Table: for Units of Quinquillions, caſting your Eye downward to the end of that Column or Series, and thence directly towards your left hand, you find the Figure 31, which ſhews it conſiſts of 31 places, *viz.* 30 Cyphers and (1) next the left hand. And thus may you find what number of places any Number in the whole Table conſiſts of.

2. Or if you would know the Value of a Number conſiſting of any number of places, it is but looking for the places in the Column of places, and caſting your Eye directly to the right hand, till you come to a Figure, which tracing upward in the ſame Series or Row, you have the Name or Value of the Number, conſiſting of any of the places given.

3. By the Table it appears alſo, that there is no more difficulty in reading a Number of 36, *&c.* places of Figures, than in a Number conſiſting of 6 places. For when any large Number is required to be read, begin at Tens place, and tell 6 towards the left hand, over which make 1: then continue to tell 6 more the ſame way, and over that make a 2: and ſo forward 6 more, and make 3, (which will fall over the 19th place:) So that having marked thus your whole Number given as in the Table above, I read, for example, the firſt Number in the Table thus:

103 Thou-

103 Thouſand, 456 Quinquillions,
789 Thouſand, 876 Quartillions,
543 Thouſand, 234 Trillions,
567 Thouſand, 898 Billions,
765 Thouſand, 432 Millions,
345 Thouſand, 678.

And the ſecond in the Table thus ;—290760 Quinquillions,
4300 Quartillions,
1325 Trillions,
732100 Billions,
73 Millions,
212437

In ſhort, the Digit being known, and the place it poſſeſſeth, we have nothing to do but firſt to mention the Digit, and then the Place. As 9 in Units place is 9 Units, 8 is 8 Units, *&c.* 9 in Tens place is 9 Tens or Ninety ; 9 in Hundreds place is 9 Hundred, *&c.* So 365 is 3 in Hundreds place, 6 in Tens place, and 5 in Units place ; or 3 Hundred, 60, and 5 : And the like of any other Numbers.

The narrow Column toward the right hand of the reſt, may ſerve to refer to the Table upon occaſion. As the Minutes ſince the Creation to *Anno* 1716 incluſive, are 3006387360, which conſiſting of ten places, is numbered as the 7th Line in the Table, with reſpect to the Names of the places : So likewiſe it being computed (in the Uſe of Multiplication) that the Number of Diamonds of a quarter of an Inch ſquare that would pave our Globe, ſuppoſing it even and all Earth, are 1281384485801164800o ; which conſiſting of 20 places, is numbered or read as the 17th in the Table. And the Value of thoſe Diamonds being *l.* 128138448580116480000o, which conſiſts of 22 places, it muſt be read as the 19th in the Table above.

Thus it appears, that the Table is abundantly large enough to afford an Example how the greateſt Number that can ariſe from almoſt any Subject, may be numbered : and, in truth, I have made it ſo large to oblige ſome curious Perſons by way of Speculation, more than for any abſolute Neceſſity there is for it.

There is likewiſe another Way of expreſſing Numbers by Letters, uſed by the *Roman* Numeriſts, and in Accounts in our antient Records, *&c.* and may be termed Literal Numbers, or the Numeral Letters ; which are theſe :

I	1	XXV	25	CC	200
II	2	XXX	30	CCC	300
III	3	XXXV	35	CCCC, or CD	400
IV	4	XL	40		
V	5	XLV	45	CDXC	490
VI	6	L	50	D	500
VII	7	LV	55	DC	600
VIII	8	LX	60	DCC	700
IX	9	LXX	70	DCCC	800
X	10	LXXX	80	CM, or DCCCC	900
XI	11	XC	90		
XII	12	C	100	M, or CIↃ	1000
XV	15	CX	110		
XX	20	CXLV	145	CIↃD	1500

CIↃDCCXX = 1720.

SECT. II. *Of Addition of Intire Numbers.*

ADDITION is a Rule whereby ſeveral (even tho never ſo many) Sums are aggregated and contracted into one Sum, called the Total.

2. If the Numbers to be added be of one Denomination, or be abſtract Numbers, it is properly called Single Addition; and in this caſe let the Name of the thing you add be what it will, you muſt for every 10 in Units place carry 1 to the Tens place, and for every 10 in that place, carry 1 to the Hundreds; for every 10 in the Hundreds place, 1 to the Thouſands place, and ſo forward, if you have never ſo many places: becauſe in Numeration it has been ſhewn, that 10 in Units is 1 in Tens place, &c.

EXAMPLES.

L. Sterling.	℔ Weight.	Ells.	Hundr. Weight.	Barrels.	
17642					
3769	9367		9763	1764	
8458	14239	9762	872	86	
4764	4763	2997	939	9	
13	8324	3862	26	732	
327	8	8764	147	876	
97864	0934	329	9183	384	
132837	37635	25714	20930	3851	Sums

l.	*s.*	*d.*
7463 :	19 :	$7\frac{1}{2}$
421 :	— :	10
833 :	4 :	$6\frac{3}{4}$
1008 :	17 :	—
94 :	12 :	$11\frac{1}{4}$
9 :	8 :	4
363 :	10 :	$10\frac{1}{2}$
1371 :	— :	$-\frac{1}{4}$
432 :	13 :	4
92 :	— :	$11\frac{3}{4}$
140 :	10 :	$9\frac{1}{4}$
832 :	— :	10
721 :	19 :	8
9367 :	3 :	11
431 :	10 :	$10\frac{3}{4}$
210 :	11 :	6
182 :	11 :	11
32 :	16 :	$8\frac{1}{4}$
1003 :	— :	7
47 :	1 :	11
82 :	— :	10
312 :	15 :	$9\frac{1}{2}$
1714 :	3 :	11
Total = 27168 :	17 :	$8\frac{3}{4}$

3. If the Numbers to be added are Contract, or have ſeveral Denominations, which depend on the Value of the ſame thing, or on the ſame Sum received and paid, *&c.* as the Column of Pounds, Shillings, Pence, and Farthings in the Margin; you muſt begin with the Farthings, and for every 4 of them carry 1 to the Pence, for every 12 Pence carry 1 to the Shillings, for every 20 Shillings carry 1 to the Pounds, *&c.* But becauſe I would not have you point at every 12 in the Pence place, which ſullies and fouls Books that are kept clean; I have therefore inſerted the following ſhort Table, that you may ſee how many Shillings is in any Column of Pence that can well be ſuppoſed to come to hand; which may ſerve till you have learned how to divide by 12: for then you need not the Table.

The TABLE uſed in Addition of Pence.

d.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*
12	= 1	60	= 5	108	= 9	156	= 13	204	= 17
24	= 2	72	= 6	120	= 10	168	= 14	216	= 18
36	= 3	84	= 7	132	= 11	180	= 15	228	= 19
48	= 4	96	= 8	144	= 12	192	= 16	240	= 20

Note,

Note, That $\frac{1}{4}$ is 1 Farthing, or one 4th part of a Penny (or other thing) $\frac{1}{2}$ is one half of a Penny, *&c.* and $\frac{3}{4}$ is 3 fourth parts of a Penny or other thing that is placed before it.

And in conſequence you find the Sum of the Farthings in the laſt Example to be 19 (or 4 Pence 3 Farthings:) Put down the $\frac{3}{4}$ (as you ſee in the Sum) and carry the 4 *d.* to the Units place of Pence, ſaying 4 and 1 is 5, and 9 is 14, and 1 is 15, and ſo on, you'll find when you come to the top of the Series 78 Pence. Put down the 8 on a piece of (by or) waſte Paper, and carry the 7 to the Tens place of Pence, ſaying 7 and 1 is 8, *&c.* till you come to 18, (at the top of the Column) which put down to the 8, and it makes 188 Pence; which by the little Table is 15 *s.* and 8 over: Therefore put down the 8 Pence, and carry the 15 *s.* to the Units place of Shillings, ſaying 15 and 3 is 18, and 5 is 23, *&c.* to the top of the Column, when the Sum is 77. Put down the 7, and carry 7 to the Tens place, ſaying 7 and 1 is 8, and 1 is 9, *&c.* which at the top you find 19. Put down the odd 1, (which makes the 7 17 *s.*) and carry half of 18 or 9 to the Pounds, which ſum up as by the Example of 1 Denomination, and you find the Sum total 27168 *l.* 17 *s.* 8 *d.* $\frac{3}{4}$.

4. Hence it may be inferred, that any Numbers may be added, tho of divers Denominations, as tho they were of one Denomination or Name. So the Sum of the ſeveral Columns of Money foregoing, is 27159 *l.* 182 *s.* 184 *d.* 19 *qrs.* or *l.* 27168 : 17 : 8$\frac{3}{4}$. for the 19 Farthings any one knows is 4 *d.* $\frac{3}{4}$, 184 Pence by the little Table is 15 *s.* 4 *d.* and 4 *d.* in the Farthings is 15 *s.* 8 *d.* 182 *s.* is *l.* 9 : 2 : — and the 15 *s.* in the Pence is *l.* 9 : 17 :— Put down the 17, and add the 9 *l.* to 27159, makes the Total *l.* 27168 : 17 : 8$\frac{3}{4}$

This is much the beſt way; done without pricking and carrying from one Denomination to another, which one is apt to forget when he has a mind to run a Sum over a ſecond time.

	l.	*s.*	*d.*	*qrs.*
	27159 :	182 :	184 :	19
Add			4 :	3
		15 :	4 :	—
	9 :	2 :	—	
	l. 27168 :	17 :	8 :	3

And by one and the ſame Method you add all kind of Denominations of Weight, Meaſure, Money, *&c.* And for reducing the Sums properly, (as that above is done) you will eaſily ſee how to do that by the little Table following of the Quarters of Hundreds, *&c.* in the Sum of the Pounds, *&c.*

TABLE 1. *Of Averdupois Weight.*

Ton	Hund.	qr.	C.	Pounds	Ounces	Drams
1	20	80		2240	35840	573440
	1	4		112	1792	28672
		1		28	448	7168
				1	16	256
					1	16

TABLE 2. *Of Engliſh Coin.*

Farth.	Pence	Groats	Shillings	*d.*	Nobles	Angels	Marks	Pounds
4	1							
16	4	1						
48	12	3	1					
320	80	20		6:8	1			
480	120	30	10			$1\frac{1}{2}$	1	
640	160	40		13:4	2	$1\frac{1}{3}$	1	
960	240	60	20		3	2	$1\frac{1}{2}$	1

Theſe Tables are put into the moſt eaſy and uſeful Method that I could think of, and are more eſpecially adapted for reducing *Averdupois Weight* (*by the firſt Table*) *and Engliſh Coin* (*by the ſecond Table*) from any one Denomination to another, with one Multiplication or Diviſion.

For the more eaſy adding this or any other Example of Averdupois greater Weight, I have inſerted the following little *Table*; which ſhews the *Quarters* of Hundreds in a Column of Pounds.

A Table of Quarters of Hundreds in a Column of Pounds.

lb	qr.C.	lb	qr.C.	lb	qr.C.
28	1	140	5	252	9
56	2	168	6	280	10
84	3	196	7	308	11
112	4	224	8	336	12

In the Example last above, having added each single Series or Row of Figures (as by the Rules for one Denomination foregoing) I find the Sum 2054 Ton, 176 Hundred, 24 Quarters, and 230 Pounds.

Then (as in the Example before) I must reduce this Sum properly, which is done thus: By the little Table last inserted, 'tis plain that in 230 lb there are 8 qrs. and 6 lb. In the 24 Quarters are 6 Hundred; and in the 176 Hundred (by taking half except Units place, and adding the odd 10 to the Units) are 8 Ton, 16 C. the Sum of which is Ton 2063 : 4 : 0 : 6, done without pricking, or any Charge to the Memory.

An Example of adding Averdupois greater Weight.

Ton	C.	qr.	lb	
47 :	3 :	2 :	27	
192 :	19 :	— :	12	
43 :	18 :	3 :	24	
973 :	— :	2 :	14	
9 :	15 :	1 :	15	
47 :	18 :	3 :	—	
55 :	9 :	2 :	23	
34 :	16 :	2 :	25	
84 :	19 :	3 :	17	
179 :	16 :	2 :	12	
84 :	8 :	1 :	25	
73 :	18 :	3 :	24	
234 :	17 :	— :	12	
Sum 2054 :	176 :	24 :	230	
		8 :	6	} Ad.
	6 :	0 :	—	
8 :	16 :	—		
2063 :	4 :	0 :	6	

But for such as can do Division, the last little Table will not be of such necessary Use, as it is to others.

A Table shewing the Ounces in a Column of Drams; or lb in that of Ounces.

16=1	80=5	144=9
32=2	96=6	160=10
48=3	112=7	176=11
64=4	128=8	192=12

The next Example is done thus:

Having summed up the Units, and then the Tens place of Drams, I find the Sum 191; the Ounces in like manner 177, and the Pounds 3234.

And by the little Table above (which any one may make or enlarge by adding 16 to itself, *&c.*) I find that the next Number to and less

leſs than 191, is 176, againſt which ſtands 11 Ounces; and 191 is 15 Drams more, therefore I put 11 *Oun.* 15 *dr.* down as you ſee. And the Sum of the Ounces being 177, I look for that in the Table, and find the next and leſs Number thereto to be 176; againſt which is 11. So that I put down ℔ 11 : 1 *Oun.* as you ſee in the Margin, and as in the foregoing Examples; which 11 added to the Pounds, and the 1 to the 11 Ounces, *&c.* the Sum reduced by the little Table is ℔ 3245 : 12 : 15.

An Example of adding Averdupois leſſer Weight.

℔	Oun.	dr.
764 :	15 :	15
73 :	13 :	12
92 :	10 :	13
173 :	— :	7
39 :	14 :	11
91 :	12 :	10
475 :	9 :	8
39 :	15 :	12
99 :	11 :	11
732 :	4 :	14
74 :	14 :	9
86 :	11 :	13
37 :	7 :	10
75 :	13 :	14
32 :	10 :	8
124 :	4 :	3
53 :	11 :	14
176 :	4 :	7
℔. 3234 :	177 :	191
	: 11 :	15 } Add.
	11 :	1 }
℔. 3245 :	12 :	15 Sum.

And thus I have given you ſundry Examples and Rules, altogether new, for adding large Numbers of ſeveral Denominations, as tho they were but one Denomination, without carrying any thing from one Name or Denomination to another: which new Method I take to be every way preferable to the common, eſpecially where there are large Examples to be added of ſeveral Denominations. I ſhall give you farther Tables, whereby little Tables may be made for Addition; or wherefrom Subſtraction and Reduction of any thing may be performed.

TABLE 3. Wine-Meaſure.

Ton	Pipes	Hogſh.	Tiertian	Gallon	Quarts	Solid Inches.
1	2	4	6	252	1008	58212
	1	2	3	126	504	29106
		1	1½	63	252	14553
			1	42	168	9702
				1	4	231
					1	57¾

TABLE

TABLE 4. *Beer-Measure.*

Pints Quarts
2——1

Pottle
4——2——1

Gallon
8——4——2——1

Firkin
72——36——18——9——1

Kilderkin
144——72——36——18——2——1

Barrel
288——144——72——36——4——2——1

Note, Ale-Measure hath 32 Gallons to the Barrel.

TABLE 5. *Dry Measure.* (36 Bushel to the Chaldron of Coals.)

Last	Weys	Quarters	Bushels	Pecks	Gallons	Pottles	Quarts	Pints
1	2	10	80	320	640	1280	2560	5120
	1	5	40	160	320	640	1280	2560
		1	8	32	64	128	256	512
			1	4	8	16	32	64
				1	2	4	8	16
					1	2	4	8
						1	2	4
							1	2

TABLE 6. *Long Measure.*

Barley-Corns. Inch
3——1

Foot
36——12——1

Yard
108——36——3——1

Pole.
594——198——16½——5½——1

Furlong
23760——7920——660——220——40——1

Mile
190080——63360——5280——1760——320——8——1

TABLE 7. Square Measure.

Square Miles	Square Acres	Square Rods	Square Poles	Square Yards	Square Feet	Square Inches
1	640	2560	102400	3097600	27878400	4014489600
	1	4	160	4840	43560	6272640
		1	40	1210	10890	1568160
			1	$30\frac{1}{4}$	$272\frac{1}{4}$	39204
				1	9	1296
					1	144

TABLE 8. Of Solid Measure.

Solid Inches.	Feet Solid	Solid Yards	Solid Poles	Rods	Acres	Mile
1728	1					
46656	27	1				
7762329	$4492\frac{1}{8}$	$166\frac{375}{1000}$	1			
1963885176	$1136507\frac{625}{1000}$	$42092\frac{875}{1000}$	253	1		
157110081408	9092061	336743	2024	8	1	
2543580610560000	147197952000	5451776000	32770584	129528	16191	1

TABLE 9. Of Troy-Weight.

Pounds lb	Ounces ℥	Pennywt. *dw.*	Grains *gr.*
1	12	240	5760
	1	20	480
		1	24

TABLE 10. Apothecarys Weight.

Grains *gr.*	Scruple ℈	Dram ʒ	Ounce ℥
20	1		
60	3	1	
480	24	8	1

TABLE

TABLE 11. *Of Time.*

Years	Weeks	Days	Hours	Minutes	Seconds
1	$52\frac{2}{11}$	$365\frac{1}{4}$	8766	525960	31557600
	1	7	168	10080	604800
		1	24	1440	86400
			1	60	3600
				1	60

TABLE 12. *Of Motion.*

Seconds	Minutes	Degrees	Sines	Quadrants	Circles
60	1				
3600	60	1			
108000	1800	30	1		
324000	5400	90	3	1	
1296000	21600	360	12	4	1

The Tables foregoing are ſo eaſy, as to need little Explanation: I have put them in two Methods, a ſmall matter differing. Table 1. which is of Averdupois Weight, is to be thus read; 1 Ton is 20 Hundred, 80 Quarters of C. 2240 Pounds, 35840 Ounces or 573440 Drams: Alſo 1 C. is 4 Quarters, 112 ℔. 1792 Ounces, *&c.* reading from the right towards the left hand, all which is uſeful in Reduction.

And the ſame is to be obſerved in the ſecond ſort of Table, only here you read the contrary way, from the right hand toward the left: As 1 Pound Sterling is $1\frac{1}{2}$ Marks, 2 Angels, 3 Nobles, 20 Shillings, 60 Groats, 240 Pence, 960 Farthings. One Mark is $1\frac{1}{3}$ (or 1 Angel and 1 Third) 2 Nobles 13 *s.* 4 *d.* 40 Groats, 160 Pence, *&c.* And the Numbers above ſhew that 4 Farthings is 1 Penny, 4 Pence 1 Groat, 3 Groats 1 *s.* 6 *s.* 8 *d.* = 1 Noble, *&c.*

As to the Proof of Addition, it is either performed by Addition or Subſtraction.

Thus the Sum of the 3 upper Lines added to the Sum of the 2 lower, is equal to the Sum Total: For the Sum of any Parts added to the reſt of the Parts, muſt give the Sum Total of all the Parts which make the Whole.

Or the Sum of the two lowermoſt deducted from the Sum Total, leaves the Sum of the greater, or of the three uppermoſt Numbers.

	9876
	5432
	1234
	567
	89
Sum Total	17198

And thus I hope I have laid down ſuch plain and copious Rules, *&c.* as will be uſeful to the young Reader in adding Money, Weight, Meaſure, *&c.*

Sum of the 3 uppermoſt	16542	
Sum of the 2 lower Lines =	656	
Sum Total, or Sum of the Sums	17198	Proof.
The leſſer deduct.	656	
Leaves the greater =	16542	Proof.

When large Sums of Money are (in Records, *&c.*) required to be expreſſed Literally, or in Numeral Letters, they may be wrote, *&c.* thus;

l.	s.	d.	
MDCCXXXVI	: VI	: IX	ob
M[10]DCCCCXXIX	: X	: II	
M[8]CCXCIX	: XI	: IX	
M[20]DLXXXVII	: X	: IX	ob
M[510]CLII	: VI	: VIII	
M[19]DCCXLV	: XIX	: VI	ob
M[60]CCXXXI	: XI	: IV	
M[631]DCLXXXII	: XVII	: ——	ob
viz. 631682	: 17	: ——	½
Sums Total			

or thus, more eaſy for Addition thereof.

l. M. C. X.	s.	d.	
I, VII, III, VI	: VI	: IX	ob
X, IX, II, IX	: X	: II	
VIII, II, IX, IX	: XI	: IX	
XX, V, VIII, VII	: X	: IX	ob
DX, I, V, II	: VI	: VIII	
XIX, VII, IV, V	: XIX	: VI	ob
LX, II, III, I	: XI	: IV	
DCXXXI, VI, VIII, II	: XVII	: ——	ob
or 631682	: 17	: ——	½
Sums Total			

To add the firſt Column 'tis eaſy till you come to the Pounds, and there add together 1ſt all under 10, to each Ten there add all Tens

Tens under 100; to thoſe add what is under 1000, and the Thouſands carry'd to the reſt.

Note, The M, C, and X are Thouſands, Hundreds, and Tens, the Titles of the Columns they ſtand over, as to place.

SECT. III. *Subſtraction of Intire Numbers.*

THIS is a Rule whereby the Exceſs or Difference between two Numbers is diſcovered; that is, we find out by this part of Arithmetic how much one of two Numbers given, is greater or leſs than the other. Thus if 15 be compared with 20, we find it leſſer by 5.

Hence it appears, that in Subſtraction there are always 2 Numbers given, from whence a third is diſcovered.

Of the 2 Numbers given, the greater I call the *Compound Number*, (as being compoſed of the leſſer Number and the Difference between thoſe given.) The leſſer I call the *Subtrahend*, it being that which is to be taken from or drawn out of the greater. And when that is done, there ariſeth the third Number, which may be termed the Remainer, Exceſs, or Difference between the Numbers given, and is the Number ſought for in this Part of the Art of Numbering.

As in Addition, ſo in Subſtraction the Numbers given are either of one ſimple Denomination, or elſe they are one or both of ſeveral Denominations or Names; for the Numbers given are Abſtract or Concrete.

I ſhall next illuſtrate what is ſaid, by Examples of one and more Denominations in the common Way of Working; and 2dly, in another.

Examples of one Denomination, or of Abſtract Numbers.

Example 1.	*Example* 2.	*Example* 3.
Lent *l.* 71032	Borrowed *l.* 19721	Received *l.* 9211
Received *l.* 9735	Paid *l.* 8957	Diſburſed *l.* 1973
Remainer *l.* 61297	Remainer *l.* 10764	Rem. = *l.* 7238

Examples of ſeveral Denominations, (or of Contract Numbers.)

Example 4.	*Example* 5.
Gained *l.* 1192 : 12 : 3	Debtor *l.* 10132 : 10 : $4\frac{1}{4}$
Loſt *l.* 287 : 14 : 7	Creditor *l.* 975 : 15 : $-\frac{3}{4}$
Remaineth gained *l.* 904 : 17 : 8	Remaineth Dr. *l.* 9156 : 15 : $3\frac{1}{2}$

Example 6.

Received as an Agent or Factor, to be applied and disburſed as *per* Order of my Employer	*l.* 9000 : — : —
Paid *A. B.* for Goods bought — *l.* 2072 : 13 : 4	
For a Ship with Rigging — 936 : 19 : 2	
For Cuſtom to the King — 97 : 15 : 3 $\frac{1}{4}$	
For Inſurance — 72 : 3 : 6	
For Freight — 100 : 11 : 9 $\frac{3}{4}$	
In all — 3280 : 3 : 1	
Which Sum of the Payments being deducted from the *l.* 9000, the Remainer (in the Factor's hands) is	*l.* 5719 : 16 : 11

Example 7.

	Weight C. qr. lb	Value l. s. d.
Bought of *A. B.* Sugars	193 : 3 : 25	386 : 19 : 4
of *C. D.* more	323 : 3 : 17	532 : 18 : 6 $\frac{1}{4}$
Bought in all	517 : 3 : 14	*l.* 919 : 17 : 10 $\frac{1}{4}$

	Weight C. q. lb	Value l. s. d.
Sold *E. F.*	25 : 1 : 14	for 59 : 17 : 6
to *G. H.*	126 : 3 : 25	at 315 : 12 : 10
to *J. K.*	94 : 2 : 14	at 235 : 17 : 6 $\frac{3}{4}$
to *L. M.*	87 : 3 : 20	at 180 : 13 : 4
Sold in all	334 : 3 : 17	at 792 : 1 : 2 $\frac{3}{4}$
Remains unſold	*C.* 182 : 3 : 25	127 : 16 : 7 $\frac{1}{2}$
Which unſold Goods coſt me		364 : 18 : 10 $\frac{1}{4}$
From which laſt Sum deducting the next above it, the Remainer is gained (already) by this Account		237 : 2 : 2 $\frac{3}{4}$

Directions for performing the foregoing Operations.

IN the firſt Example you are to take the lower Line from the upper, or the leſſer Number 9735 from 71032. Begin at Units place, and ſay 5 from 2 cannot be, but 5 from 10, which you muſt borrow, and add to 2; that is, 5 from 12, and there remains 7. Then having put the 7 under the Line, ſay 1 borrowed and 3, (the Figure in Tens place of the Subtrahend) is 4, from 3 (in the compound

pound Number) can't be; but from 13 (borrowing 10 as before) leaves 9. Which put down, as you ſee, and ſay 1 borrowed and 7 (the Figure in Hundreds place of the Subtrahend) is 8 from 10 borrowed (becauſe you can't take 8 from 0) and there reſts 2. One borrowed and 9 is 10 from 1 (in the Thouſands place of the compound Number) can't be, but 10 from 11 leaves 1, which put under, as you ſee. And laſtly, 1 borrowed from 7 in the upper Line, and the Remainer is 6. So the whole Sum remaining is 61297. And thus any Operation of one Denomination is performed.

Then for ſeveral Denominations I ſhall inſtance, 1*ſt*, in the fifth Example. You muſt always begin with the leaſt Name, here Farthings; and ſay 3 Farthings from 1 can't be, but borrowing 1 Penny or 4 Farthings, add to the 1 Farthing makes 5; ſo 3 from 5, and there reſts 2 Farthings: put under as in the Example, and ſay 1 Penny borrowed from 4 Pence in the upper Line, and there reſts 3*d.* Then ſay 15 *s.* from 10*s.* can't be; but 15 from 20 *s.* which you borrow, and the 10, *viz.* from 30, and there reſteth 15. Then ſay 1 borrowed and 5 is 6, from 12, reſts 6 Pounds, *&c.* as in the former Examples.

The ſixth Example is performed by firſt adding together the Sums laid out, and then deducting that Sum, which is *l.* 3280 : 3 : 1 from the 9000. Thus 1 *d.* from 12 you borrow, leave 11 *d.* 1 you borrowed and 3 *s.* is 4 from 20 *s.* which borrow, and the reſt is 16; which put under, and deduct the 1 borrowed from 10, *&c.* as before.

Laſtly, In the ſeventh Example you are to deduct the Hundreds, Quarters, and Pounds ſold from thoſe bought: to perform which, you muſt ſay 17 Pounds from 14 lb can't be, but 17 from 28 lb which you borrow (that being a Quarter of a Hundred, which is the next Denomination) leaves 11; which added to the 14 lb, makes the 25 which you ſee. Then 1 Quarter of a Hundred borrowed and 3 is 4, from 7 (that is, 4 Quarters or 1 Hundred borrowed and added to the 3 Quarters ſtanding in the upper Line) and the reſt is 3 Quarters; which put in the Remainer, ſaying 1 (that is, 1 Hundred weight) borrowed and 4 (in the Sum of the Sales) is 5, from 7 in the Hundreds bought, leaves 2; which put down, and ſo proceed, as in ſubſtracting one Denomination: and the quantity of Sugar remaining unſold you find to be C. 182 : 3 : 25. And the Value of what is ſold deducted from the whole Value bought, the Remainer is *l.* 127 : 16 : $7\frac{1}{2}$ (which is the Sum only

wanting

wanting to make up the Coſt of all that was bought.) Which Sum remaining deducted from the prime Value of what Sugar remains unſold; *viz.* 182 *C.* 3 *qr.* 25 *lb.* which coſt *l.* 364 : 18 : 10¼ the remaining Caſh is *l.* 237 : 2 : 2¾ which is got by this Trading, thus far.

Note, Tho the Subtrahend, as here *l.* 127 : 16 : 7¾ ſtands over the Compound Number *l.* 364 : 18 : 10¼, it is as eaſily deducted as if the leſſer Number ſtood under the greater, as is moſt uſual.

By the Rules and Examples above, I ſuppoſe any one may perform Subſtraction after the common way.

But the Work may be effected without ſaying *ſuch a Figure from ſuch a one can't be*, and 1 *borrowed*, &c. as in the Margin.

			10	10	10	10	
		4	6	1	2	3	10
From	1	5	7	2	3	4	2
Take		8	9	5	6	5	7
Reſts =		6	7	6	6	8	5

For where any Digit in the compound Number is leſs than that ſtanding under it in the Subtrahend, mark the next toward the left hand with a Point, and put over it a Digit, which is 1 leſs, as here over 4 in the Number given put 3 ; over 3, 2, *&c.*

Then where the Figures put over the pricked ones (or thoſe given) are ſtill leſs than thoſe reſpectively in the Subtrahend, place 10 partly over, but a little toward the left hand ; then you have the very Numbers at large, from whence Subſtraction is to be made. Thus 7 from 12 reſts 5, 5 from 13 reſts 8, 6 from 12 reſts 6 ; 5 from 11 leaves 6 ; 9 from 16 leaves 7, and 8 from 14 leaves 6.

Now I have only inſerted the Figures over thoſe pointed, and the Tens to explain the Rule ; but 'tis certain, the Work may be as eaſily performed mentally, by ſuppoſing every Figure as aforeſaid leſs by the 1 (ſuppoſed 10) which is borrowed from the next towards the left hand of the Number given to make Subſtraction from. For whenever you borrow 10, that 10 is preſumed to be taken from the next Figure towards the left hand ; and of conſequence therefore that is 1 leſs, (1 in any Series being 10 in another next it toward the right hand.) Thus in the Example, 7 from 12 reſts 5 ; where the one Ten borrowed makes the Figure in Tens place a Unit leſs, *i. e.* the 4 is but 3. And when you ſay 5 from 13 reſts 8, this 1 borrowed is actually taken from the next Digit 3, and leaves it but a 2, and ſo 2 becomes but a 1, 7 a 6, and 5 a 4, which is all ſuppoſed as you perform the Work, without putting down any thing but the Remainer.

So

So alſo in divers Denominations, the Unit borrowed being ſuppoſed one of the next ſuperior Denomination, muſt leave that a Unit leſs, as is explained in the Margin. Where 2 *s.* 6 *d.* 1 *qr.* in the upper of the two Lines given, being leſs than 17 *s.* 9 *d.* $\frac{3}{4}$ in the lower Line; therefore 4 Farthings taken from the 6 *d.* makes the $\frac{1}{4}$ $\frac{5}{4}$, and 5 *d.* reſteth; 12 *d.* borrowed from the 2 *s.* and put over the 5 *d.* makes 17 *d.* and 1 *s.* reſteth; 20 *s.* taken from the 3 *l.* makes the ſaid 1 *s.* to be 21 *s.* and 2 *l.* reſteth, *&c.* as in one Denomination; then I have it plain to my ſight, that $\frac{3}{4}$ from $\frac{5}{4}$ leaves $\frac{2}{4}$ or $\frac{1}{2}$; 9 *d.* from 12 and 5 or 17 *d.* leaves 8; 17 *s.* from 21 leaves 4 *s.* 7 *l.* from 12 *l.* leaves 5; 9 *l.* from 10 leaves 1 *l.* and 3 *l.* from 6 *l.* leaves 3, without borrowing and paying. Which Method with Uſe will make the Work eaſier and ſhorter than the common way: I mean, when only the two Sums given are wrote down, and the reſt performed in the Mind, as in Example.

	l.	*s.*	*d.*
	10,	10	2 0 1 2
	6,	0	2 1 5 $\frac{1}{4}$
Acquired or earned	7	13	2 : 6 $\frac{1}{4}$
Expended =	3	9	7 : 17 : 9 $\frac{3}{4}$
Saved, or put in Bank	3	1	5 : 4 : 8 $\frac{3}{4}$ or $\frac{1}{2}$

This is done without the leaſt mentioning borrowing or paying, and with more Eaſe and Expedition; and may ſerve alſo to ſhew the Nature and Reaſon of the common Way of Working.

	l.	*s.*	*d.*
The Rent-Roll of my Eſtate (ſuppoſe) is *per annum* —	1765	12	3
Repairs, Taxes, *&c.* deduct.	279	15	9
My clear Eſtate *per ann.* =	1485	16	6

The Proof of Subſtraction is either *by Addition* or Subſtraction: For in the laſt foregoing Example, the Remainer *l.* 1485 : 16 : 6 being added to the Subtrahend, *l.* 279 : 15 : 9, the Sum is the compound Number given, or *l.* 1765 : 12 : 3; which proves the Operation to be right.

Or by Subſtraction. If from the *l.* 1765 : 12 : 3 you take the Remainer *l.* 1485 : 16 : 6, there will then remain *l.* 279 : 15 : 9 = the Subtrahend given.

SECT.

SECT. IV. *Multiplication of Intire Numbers.*

MULTIPLICATION is a Rule which ſhews the Number of Units produced by making one aſſigned Number any Multiplicity of times itſelf.

Or 'tis that Part of Arithmetic of ſuch admirable Extent, that no Number or Quantity can be ſo great, but another greater may be diſcovered: For by it not only the Number of ſingle Sands that would compoſe an Heap as big as our Earth, but even one to extend to the ſtarry Firmament are within the limits of this part of the Numeric Art to compute.

It is an Abridgment of the Work of Addition, performing that in a Minute, that Addition would require ſome Hours to do.

Thus if 8766 were to be multiplied by 20000, (or to know how many Hours are in 20000 Years) 'tis only to double 8766, which is 17532, and to that place the four Cyphers toward the right hand will make it 175320000 the Anſwer, (which is done in leſs than half a Minute.) But how long it would require to put down 8766, 20000 times; or 20000, 8766 times; and then add all thoſe Numbers together; I leave the Reader to judge, and conſeqnently of the Excellency of this Rule, which is juſtly called Multiplication.

As in the laſt Section, ſo in this Part there are two Numbers given to find a third: To inſtance, as above, 8766 and 20000 are given, and 175320000 is the Number produced by or reſulting from the Multiplication.

Of theſe 3 Numbers 1 (commonly the greater of the 2 given) is called the Multiplicand, the other of thoſe given is the Multiplier, and both together they are called Factors; and the Number ariſing therefrom after Multiplication, is called the Product, or (in Geometrical Operations) the Rectangle.

The Relation theſe three Numbers have to each other, is, That the Product containeth either of the Factors ſo often as the other Factor contains a Unit: and conſequently

As 175320000. to 8766 :: ſo 20000. to 1. Or

As 175320000. to 20000 :: 8766. 1. *&c.* But this by the by, till we arrive at the Rules of Proportion.

The whole Buſineſs of Multiplication conſiſts in theſe three things:

1. In knowing mentally and readily what any two Digits multiplied together produce.

2. In the right placing thoſe Products. And,
3. In collecting thoſe particular Products into one general Product.

Hence it follows, that a Table of the Products of one Digit by another be compoſed, which, before you can proceed farther in this moſt pleaſant and uſeful Science, muſt be learned by heart: thus

The firſt Column is what is abſolutely neceſſary to get by heart.

The ſecond Column for the moſt part, that is, in multiplying by 10 and 11, does not charge the Memory: for to multiply any Number by 10, is only to place a Cypher to the right hand of the Multiplicand, (for 1, tho a Number, as augmenting and diminiſhing another by Addition and Subſtraction, yet it neither multiplies nor divides.)

And to multiply any Digit by 11, is only to repeat the Digit as in the Example. And I have added the Multiplication of the Digits by 12, becauſe that 1 being got by heart, ſaves the trouble of making a whole Line, and of adding two Lines together: for when you have that by heart, you can multiply or divide by 12 (a Number much uſed, as being the Pence in a Shilling, the Inches in a Foot, *&c.*) as by one ſingle Digit.

The Multiplication Table.

3 times	3 is = 9	10 times	2 = 20
	4 = 12		3 = 30
	5 = 15		4 = 40
	6 = 18		5 = 50
	7 = 21		6 = 60
	8 = 24		7 = 70
	9 = 27		8 = 80
4 times	4 = 16		9 = 90
	5 = 20	11 times	2 = 22
	6 = 24		3 = 33
	7 = 28		4 = 44
	8 = 32		5 = 55
	9 = 36		6 = 66
5 times	5 = 25		7 = 77
	6 = 30		8 = 88
	7 = 35		9 = 99
	8 = 40	12 times	2 = 24
	9 = 45		3 = 36
6 times	6 = 36		4 = 48
	7 = 42		5 = 60
	8 = 48		6 = 72
	9 = 54		7 = 84
7 times	7 = 49		8 = 96
	8 = 56		9 = 108
	9 = 63		10 = 120
8 times	8 = 64		11 = 132
	9 = 72		12 = 144
9 times	9 = 81		

The wonderful Productions ariſing from the placing Numbers, are many and ſurprizing: I ſhall here inſert an Inſtance, where, by placing only 9 Figures to the beſt advantage about 5 Digits given, conſtitutes all the Parts of the common Table that are abſolutely neceſſary to be inſerted for the more apprehenſive part of Readers.

A moſt Brief Multiplication-Table, viz.

Two of theſe multiply, ſtanding againſt the Numbers given.	Two of theſe given to be multiplied, or to be ſquared.	Two of theſe add, reſpecting the given Numbers in the middle.
1	9	40
2	8	30
3	7	20
4	6	10
5	5	0

The large Table is ſo plain, that it needs no Explanation, as ſhewing that 8 times 8 is 64, 8 times 9 is 72, and the like of the reſt.

And this Table is very near as eaſy; for you muſt always look for the Digits to be multiplied, in the middle Column: As ſuppoſe I would know what 8 times 6 makes; againſt 8 in the middle Column is 30 towards the right hand, and againſt 6 in the middle is 10 in the right-hand Column, the Sum of which is 40; and thoſe ſtanding againſt the others, in the left-hand Column, are 2 and 4, which multiplied together, make 8: ſo that 8 times 6 is 48.

And to ſquare any of the middle Numbers, as ſuppoſe 7, double 20, which ſtands againſt it on one ſide, and multiply that by itſelf, which ſtands againſt 7 on the left-hand ſide; ſo 20 doubled is 40, and 3 ſquared makes 9: ſo that 7 times 7 is 49, *&c.*

So much for the Tables: I ſhall now proceed to ſhew how the Operation of Multiplication is performed. And,

2. The Application of the Rules in ſolving Queſtions, which may ſerve, inſtead of Reduction deſcending, to ſhew the Uſe of Multiplication.

Pro-

Propoſition 1. To multiply a Number by another, which conſiſts but of one place.

Example 1.

Multiplicand 79533
Multiplyer 8

Product 636264

Example 2.

Multiply—— 175945
by 9

Anſwer = 1583505

Prop. 2. To multiply any Number by another conſiſting of two, three, or more places. A ſhorter way for Example 1. See *Multiplication of Decimals.*

Example 1.

Multiply 74963
by ...75

374815
524741

Product=5622225

Example 2.

47625
357

333375
238125
142875

Product = 17002125

Example 3.

76472
2475

382360
535304
305888
152944

Product = 189268200

Prop. 3. To multiply when one or more Cyphers are in the Multiplyer, but not at the end.

Example 1.

Multiply 57234
by 5203

171702
114468
286170

297788502

Example 2.

97532
32004

390128
195064
292596

3121414128

Prop. 4. How to do when one or more Cyphers are next the right hand of one or both of the Factors.

Example 1.

9769 } Factors.
1000 }

9769000 = Product =

Example 2.

7399 } Factors.
400 }

2959600 = Product.

Example 3.

34000 } Factors.
2300 }

102
68

Product = 78200000

Rules for performing the Operations above.

In Example 1.] Say 8 times 3 (the Units place of the Multiplicand) is 24; put the 4 under the Line, and carry the 2 Tens to the next Product, saying 8 times 3 is 24, and 2 carried is 26; put 6 in Tens place of the Product, and carry 2 as before, saying 8 times 5 is 40, and 2 carried is 42; put the 2 under the Line as you see, and carry 4 (Tens) saying 8 times 9 is 72, and 4 carried is 76: put the 6 under, and carry the 7, saying 8 times 7 is 56, and 7 carried is 63, which (being the Produce of the last Figure) put all down, and you see that 8 times 79533 is 636264. And so much for Directions to multiply and carry the Tens from one particular Product to another; the Reason of which, and of placing the several Products a degree towards the left hand, I shall shew by and by.

In Example 2. *of Prop.* 2.] You find by the Rules above, that 7 times 47625 is 333375; and then you multiply 47625 by 5 (the next Figure in the Multiplyer) saying 5 times 5 is 25: place that 5 under Tens place of the former Product, and proceed as before; and when you come to the 3, put 5 of the Product 3 times 5, under the Tens place of the last Line or Product; and so continue, if you had never so many Figures in the Multiplyer, as you see in the other Examples.

In Proposition 3.] You have Examples, that when one or more Cyphers are in the middle of the Multiplyer, you must (in beginning to multiply by the Digit next the Cyphers towards the left hand thereof) place the first Figure of the Product not under Tens place of the former Product, as before; but put it so many places extraordinary towards the left hand as there are Cyphers: the Examples thorowly explain the Meaning.

In Prop. 4.] It is shewn, that whenever Cyphers are to the right hand of either or both Factors, you need only to multiply by the significant Figures or Digits, and then place all the Cyphers in one or both the Factors towards the right hand of that Product; and when 10, 100, 1000, *&c.* is the Multiplyer, you need only to put the Cyphers towards the right hand of the Multiplicand, and that is your Product, as by the first Example of this Proposition.

The Reaſon of the Method in the Proceſs of the Work of Multiplication, by ſeveral Digits in the Multiplyer.

I ſhall give an Inſtance in the Work of the ſecond Example of the ſecond Propoſition foregoing; and ſhall explain this by three Examples depending on each other, the ſecond of which, ſuppoſing the Cyphers left out, is an Abbreviation of the firſt; and the third Example ſhews how much the Number of Figures in the ſecond Example is leſſened by carrying the Tens from the Product of every two Digits to that of the next, *&c.* and not putting the whole down, which reduceth 15 Numbers into 3.

Example 1.	*Example* 2.	*Example* 3.
47625	47625	47625
357	357	357
35	35	
140	14 | 0	
4200	42 | 00	
49000	49 | 000	
280000	28 | 0000	
	——— 333375 = Sum	
250	25 | 0	
1000	10 | 00	
30000	30 | 000	
350000	35 | 0000	
2000000	20 | 00000	
	——— 238125 = Sum	
1500	15 | 00	
6000	6 | 000	
180000	18 | 0000	
2100000	21 | 00000	
12000000	12 | 000000	
	——— 142875 = Sum	
Sum = 17002125	17002125	17002125 Sum Total
or Product		or Product.

In the firſt of theſe Examples you have the whole Work of the Multiplication as the Figures ſtand, the whole being put down without Carrying or Abridgment; as 7 times 5 is 35, 7 times 20 is 140,

140, 7 times 600 is 4200, *&c.* Then 50 times 5, 20, 600, 7000, and 40000 make the next 5 Lines: And 300 (the third Figure in the Multiplyer) times 5, 20, 600, 7000, and 40000 make the laſt 5 Lines or Numbers in the Operation.

In the ſecond Example you ſee how the Work ſtands when the unneceſſary Cyphers are cut off, and thrown out of the Account. And

In the third Exampie you ſee that the Sum of the Numbers ſeparated from the Cyphers do reſpectively make the Numbers, and fall in the ſame Order as in the ſecond Example of Prop. 2. So that here you ſee not only the Reaſons why the Tens are carried from one ſingle Product to another, when 1 Line or Number is only made inſtead of 5: but you alſo ſee plainly the Reaſon why the Units place of every Line ſtands under Tens place of the Product or Line of Figures preceding.

Thus much for the Theory of Multiplication, I ſhall next ſhew,

II. *The Uſe and Application of Multiplication.*

1. *Of Money.*] *Pounds* are reduced immediately into Shillings, Pence, or Farthings, by multiplying the given Pounds by 20, 240, or 960, as *per* Table 2. in Addition.

Example, in 7873 *l.* how many Shillings? *&c.*

7873 Pounds } Multi-
20 Shill. in *l.* 1. } ply.

Sh. 157460 = the Anſwer.

Examp. 2.

l. 7873
240 *d.* in *l.* 1.

31492
15746

Examp. 3.

7873 *l.*
960 *qr.* in *l.* 1.

47238
70857

Pence for Anſwer 1889520 Farth. 7558080 Anſw.

Note, Theſe Shillings may be reduced into the Pence by multiplying them by 12; and theſe Pence into the Farthings by multiplying by 4. And the like of any other Pounds, Shillings and Pence.

Queſt. 2. In *l.* 7873 : 18 : 11 $\frac{3}{4}$ how many Farthings?

Multiply 7873 by 960, as in the third Example; to the Product whereof add 911 = the Farthings in 18*s.* 11 *d.* $\frac{3}{4}$ and the Sum is the Anſwer, as *per* Margin.

l. 7873 : 18 : 11 $\frac{3}{4}$
960

47238
70857

7558080
Add .... 911 qr. in 18*s.* 11*d.* $\frac{3}{4}$
Sum = 7558991 = Anſwer.

2. *Of*

2. *Of Averdupois Weight.*] By the first Table in Addition it appears that Tons are reduced into Hundreds by multiplying them by 20; into Quarters of Hundreds by 80; into Pounds by 2240; into Ounces by 35840, *&c.*

Example, In 85 Ton how many Ounces?

Ounces in 1 Ton = 35840
Tons given 85

17920
28672

3. *Of Liquid Measure.*] In 157 Ton of Wine, how many Quarts? By the third Table in Addition, you see that in 1 Ton are 1008 Quarts: therefore the Tons being multiplied by 1008, gives the Product 158256 Quarts.

157 Ton. | Answ. Oun. 3046400
1008 = Quarts in 1 Ton.

1256
157

158256 Quarts, Answer.

4. *To reduce Time.*] How many Minutes may we say 'tis since the Creation, supposing the Years, according to Sacred Chronology to be 5716?

By the eleventh Table in Addition, there are in 1 Year ——— } 525960 Minutes } Multiply.
5716 Years

315576
52596
368172
262980

5. *To reduce Square or Superficial Measure.*] How many Diamonds, of 16 in a square Inch, will pave the Globe we live on, supposing it a compleat Sphere or Globe all of Earth?

300638736o Minutes for Answer.

The Ambit (or Circumference) of the Earth, according to Mr. *Norwood's* measured Degree of near 70 *English* Miles in a Degree, is Miles ——— } 25040

A fourth of which is Miles ——— 6260
Which multiplied by the Earth's Diameter = 7967

4382
3756
5634
4382

The Product is the superficial Content of a Circle, whose Circumference is that of the Earth, *viz.* ——— } 49873420

Product

Product brought over ——— 49873420

4

Which multiplied by 4, produceth the convex Area of the Earth (or whole Superficial Content) in Square Miles ——— 199493680

Which multiplied by the ſquare Yards in one ſquare Mile, which are (as *per* Table the 7th) ——— 3097600

119696208
139645576
17954312
5984810 4

The Product is the ſquare Yards on the Earth = 617951623168000

Which multiplied by the Inches in a ſquare Yard, which are ——— 1296

3707709739008
55615646085 12
1235903246336
617951623168

Produceth the ſquare Inches on the Earth's Surface ——— = 800865303625728000

Which multiplied by the Diamonds in 1 ſquare Inch, *viz.* 16

4805191821754368
800865303625728

Produceth the Number of Diamonds which anſwers the Queſtion ——— 12813844858011648000

100

And the Value of the Diamonds (aforeſaid) that would pave the Globe at 100 *l.* each Diamond, is Pounds Sterling ——— 1281384485801164800000

This Value is numbered as the 16th in the Numeration-Table.

By all which Examples it appears, that in this kind of Reduction, which ſome call Reduction deſcending, one general Rule is to be obſerved, *viz.*

Multiply any Number of any Denomination by any Number of Units of a ſmaller or inferior Name, that make a Unit of that given, and the Product ſhews how many of the latter are contained in all the former.

For

For Proof of Multiplication, see at the end of *Division.*

Note, *That many new and very brief Rules and Examples for Multiplication may be seen in Decimals.*

SECT. V. *Division of Intire Numbers four several Ways.*

DIVISION is that Part of Arithmetic by which a Number given is divided, separated, or distributed into any Number of Parts assigned.

Hence 'tis plain, that it is the Reverse of Multiplication; for as that produceth an Increase, so this produceth a proportionable Decrease: and consequently the Truth of any Product of Multiplication, is proved by dividing it by one of the Factors, of which more hereafter.

Division performeth the Work of many Substractions (as Multiplication does that of many Additions) by a few Figures, and in a small Time; which Substraction would require an incredible deal of Time, Figures and Paper, to effect. To instance in the former Numbers: If it were proposed to find out how many Years are in 175320000 Hours, there being 8766 Hours in 1 Year, therefore to do this by Substraction, would require that you deduct 8766 so often from 175320000, till nothing remain, which would be after 20000 Deductions. But the Work of Division shews the Answer with that brevity which you see in the Margin.

```
8766)175320000(20000
     ---------
           0
```

It appears from hence, That in Division there are always 2 Numbers given, and a third sought for. The Numbers given, are, 1st, That which is required to be divided, which we call the *Dividend.* 2dly, The Number of Shares, Parts or Portions, into which the said Dividend is assigned to be parted or divided, which we call the *Divisor.* 3dly, The Part or Share arising from the Work of Division (being the Number sought for) we call the *Quotient*, (from *quotiens*, *i. e.* how many times) which shews how often the Divisor is contained in the Dividend.

And if the Dividend contain somewhat more than the Quotient expresseth, (but not so much more as the Divisor amounts to) that Surplusage is called the Remainer or Remainder.

So that the Relation which the two Numbers given and that sought (supposing no Remainer) have to each other, is, That the Dividend contains either the Divisor or Quotient so often as the

other doth a Unit: For as a Unit to the Divisor :: so the Quotient to the Dividend.

Or as a Unit to the Quotient :: so the Divisor to the Dividend; and consequently

The Product of the Divisor and Quotient is equal to the Dividend by 1; any of which Considerations proves the Truth of the Work of Division.

The Operation of Division consists in these five things.

1. In considering how many places toward the left hand of the Dividend the Divisor can be taken from: If from the like Number of Places that are in the Divisor, then,

2. To consider how often the first Figure in the Divisor can be had in the first of the Dividend towards the left hand. But if the Divisor cannot be taken from the like Number of Places with itself from the Dividend; then to ask how often the first Figure in the Divisor (as before) can be had in the two first places towards the left hand of the Dividend: In either of which Cases,

3. We put the Answer in the Quotient, (as you see in the Example.)

4. By that Figure so put in the Quotient, we multiply the Divisor, and put the Product under that part marked out in the Dividend.

5. We deduct that Product from the said marked Part or Dividual, and put the Remainer under a Line, as in the Examples.

Propositicn 1. To divide by any single Figure or Digit.

Example 1.

Divisor	*Dividend*	*Quotient*
7	8765432 1	1252264 5
	7	
	17	
	14	
	36	
	35	
	15	
	14	
	14	
	14	
	032	
	28	
	41	
	35	
	6 Remainder	

Exam-

Example 2.

8) 1743219 (217902
16
14
8
63
56
72
72
019
16
3 remains.

Example 3.

9) 90123456 (10013717
9
0012
9
33
27
64
63
15
9
66
63
3 remains.

Prop. 2. To divide by 2, 3, or more Figures in the Divisor.

Example 1.

21) 7334565 (349265
63
103
84
194
189
55
42
136
126
105
105
0

Example 2.

136) 1234567 (9077
1224
1056
952
1047
952
95 rests.

Example 3.

9876) 1234567 (125
9876
24696
19752
49447
49380
67 rests.

Prop. 3. To divide by a Divisor having Cyphers in the first, second &c. places thereof.

Example 1.

350) 987654 (2821
70
287
280
76
70
65
35
Rests 304

Example 2.

12000) 987654 (820
96
27
24
Rests 3654 to divide by 12000.

Example 3.

1000) 976432 = Answ.
Quote = 976
Remains 432

Rules for performing the Work of the three last Propositions.

Those by 1 Figure under *Prop.* 1. are so easy, that any one may divide, observing the five general Rules for proceeding. To instance in Example 2. I ask how often 8, the Divisor, can be had in 17, the two first Figures to the left hand of the Dividend, (because I cannot have 8 in one place of the Dividend) the Answer is 2 times; which 2 I put in the Quotient, and say 2 times 8 (the Divisor) is 16; which placing under the 17, and taking the 16 from 17, the Remainer is 1. To which bring down the next Figure 4 in the Dividend, (and as you bring down any Figure to a Remainer, mark it with a Point under, lest you bring it down twice) and then say how often 8, the Divisor, can be had in 14, the Answer is 1; which put in the Quotient, and say 1 time 8 is 8, which put under and deduct from 14, and the Remainer is 6; to which bring down 3, (the next Figure in the Dividend) and ask how often 8 in 63, the Answer is 7, which put in the Quotient; and so go on to the end of the Work, observing this Rule, That if after you have brought any Figure down to a Remainer: you cannot have the Divisor in it; you must put a (0) in the Quotient, and bring down the next Figure, as in the last Figure but one of the Example we are upon.

Prop.

In the Examples to Prop. 2. It is almoſt as eaſy to divide by 2, 3, or 4 Figures as 1, obſerving chiefly this Rule; as in Example 2. of this Prop. I ask how often 1 (the firſt Figure in the Diviſor) may be had in 12, (the two firſt Figures in the Dividend) the Anſwer would be 12 times; but you muſt never take it above 9, that is, you muſt never put above 9 in the Quotient at one time. And alſo obſerve, that you do not put that 9 in the Quotient till you have tryed on a piece of waſte Paper whether 9 times 136 do not exceed 1234, (the firſt part of your Dividend) which, finding it leſs, may conſequently be taken from it; So 9 times 136 is 1224, from 1234, and there reſts 10; to which bring down the next Figure (5) in the Dividend, and conſider how often 136 (the Diviſor) can be had in 105, the Anſwer is (0) which put in the Quotient, and then bring down the next Figure 6 makes 1056. Then ſay how often 1 (the firſt of the Diviſor) can you have in 10, (the two firſt of that part of the Dividend, becauſe that has one place more in it than is in the Diviſor:) If you ſhould ſay, 1 may be had 9 times or 8 times in 10, you will find that the Diviſor multiplied by either of thoſe Figures will exceed 1056, and ſo cannot be taken from that Number. Wherefore finding that 7 times 136 will be leſs than 1056, I put 7 in the Quotient, and multiplying 136 by 7, it produceth 952; which take from 1056, and the Remainer is 104: To which bring down the 7 (the laſt in the Dividend) makes 1047, and ſay how often 1 (the firſt of the Diviſor) can be had in 10 (the two firſt of the ſaid 1047) the Anſwer is 7 times, (for it will bear no more, without making the Product of the Diviſor thereby to exceed the 1047) ſo 7 times 136, which is 952, deducted from 1047, the Remainer is 95: So that I find I can have 136 in 1234567, 9077 times, and 95 reſts. By obſerving theſe Rules you'll eaſily ſee how to perform the Work of this Example, and by this any other; and I have been particular in giving Rules for that end.

In the Examples under Prop. 3. When Cyphers are in the firſt, ſecond, *&c.* places of the Diviſor, cut off the Cyphers, and as many Figures towards the right hand of the Dividend, and divide thoſe remaining towards the left hand of the Dividend by thoſe that remain towards the ſame hand in the Diviſor: and when the Work is ended, put the Figures cut off the Dividend to the right hand of the Remainer.

And for the third Example, to divide any Number by 10, 100, 1000, 10000, *&c.* You have nothing to do but only cut from the right hand of the Dividend ſo many places as there are Cyphers at the end of the Diviſor: ſo thoſe remaining towards the left hand of the Dividend

vidend are the Quotient, and those cut off towards the right hand are the Remainer.

But there is

A Second Way of Division:

Where by omitting to put down the several Products, and deducting gradually as you multiply each Digit, you do it with near half the Figures.

Thus the third Example under Prop. 2. is done as in the Margin. For I say how often 9 in 12, the Answer is 1; then instead of saying once 9876 is so much, and putting it under 12345, I say 1 time 6 from 15, (where 10 is added to the 5 in Units place of 12345) and there rests 9, which put under, and saying 1 time 7 and 1 borrowed is 8 from 14 rests 6; 1 time 8 (in the Divisor) is 8, and 1 borrowed is 9, from 13 (borrowing 10 as before) and there rests 4, which put under, and say 1 time 9 (in the Divisor) is 9, and 1 borrowed is 10 from 14, and there rests 2. Then to the Remainder 2469 bring the next Figure in the Dividend, *viz.* 6, and say how often 9 in 24, the Answer is 2; then proceed as before, 2 times 6 is 12 from 16 rests 4, 2 times 7 is 14, and 1 is 15, from 19, rests 4; 2 times 8 is 16, and 1 borrowed is 17, from 26, and there rests 9, (you borrowing 2 to add to the 6 is 26) 2 times 9 is 18, and 2 borrowed is 20, from 24, leaves 4, or 4944; to which bring down the 7 in the Dividend, and proceed as before.

```
9876) 1234567 (125
      ...
      24696
      49447
      67 rests.
```

I desire this Method last mention'd may be well understood, for that the subsequent Examples will be performed by it, as being the shortest and easiest Way, tho some prefer this.

A Third Way of Division.

Divide 1234567 by 136.

In this kind of dividing, the Divisor is put under so much of the Dividend as it can be taken from; for 136 can't be taken from 123, therefore I put it under 1234, the first part of the Dividend, and then ask (as in the second Example of Prop. 2.) how often 1 in the Divisor can be had in 12 in the Dividend, the Answer is 9 times; which 9 put in the Quotient as

```
x09
x0045
x234567 ( 9077
x366 6
x3 3
x
```

usual,

uſual, and ſay 9 times 6 in the Diviſor is 54, from 54, (borrowing 5 to add to the 4 ſtanding over the 6, and as you mention 6 and 4, daſh them out with your Pen) there reſts 0; 9 times 3 in the Diviſor is 27, and 5 borrowed is 32, from 33 (borrowing 3 Tens to add to the 3 ſtanding over the 3 in the Diviſor) and there reſts 1, which put over the 3, as you ſee. Then remove your Diviſor a degree towards the right hand, as in the Example, and conſider how often 136 you can have in 105, (which is 10 that remained, and 5 next the 4 in the Dividend) the Anſwer is 0, which put in the Quotient, and taking the next Figure, *viz.* 6, into the 105, makes 1056; ſay how often 136 in 1056, or 1 in 10, the Anſwer is but 7 times; then 7 times 6 is 42, from 46, and there remains 4, which put over the 6, (daſhing it out, and alſo the 6 in the Diviſor) ſaying 7 times 3 is 21, and 4 borrowed is 25, from 25, (borrowing two Tens) and there reſts 0, which put down over the 5, ſaying 7 times 1 is 7, and 2 is 9, from 10 leaves 1, which put over the Cypher as you ſee, daſhing out the Figures in the Diviſor as you multiply them, and of the Dividend as you deduct therefrom. Then remove the Diviſor, and proceed as before, and as you ſee in the Example.

But there are two things which render this way of Diviſion inferior in Eſtimation to the ſecond, *i.e.* the repeating the Diviſor for every Figure put in the Quotient; and alſo the cancelling the Figures, makes it very difficult to examine your Work in caſe of a Miſtake.

The Illuſtration and Rationale of the Work of Diviſion.

I ſhall inſtance in admitting that 9876543210 were to be divided by 45678.

A Fourth Way of Division; or, The Operation of Division illustrated.

Products of the Divisor.	*Divisor repeated*		
by 1=45678	45678)	9876543210	(200000 = first Quotient.
		9135600000	
2=91356			
		740943210	—10000 = second Quote.
3=137034	45678	456780000	
4=182712			
	45678	284163210	—6000 = third Quote.
5=228390		274068000	
		10095210	—200 = fourth Quote.
6=274068	45678	9135600	
7=319746			
	45678	959610	—20 = fifth Quote.
8=365424		913560	
		46050	—1 = sixth Quote.
9=411102	45678	45678	
The Tarif.			216221 = Sum or Gene-
		resteth 372	ral Quotient.

In the beginning of this Part or Section, Division is said to be the Work of many Substractions, and so it is plain: But then we are taught here how to go a nearer way to work than to deduct the Divisor singly; for in the first Operation above, we deduct 200000 times the Divisor at one time, (which are all the 100000's of the Divisor that are contained in the Dividend.) At the second Working we deduct 10000 times the Divisor, (which is all the 10000's of the Divisor that is in the Dividend.) The third time we take 6000 times the Divisor from the Dividend, then 200 times, then 20 times, and then 1 time the Divisor from the Dividend: So that by this Art of Division you deduct at 6 times what by Substraction would require 216221 times to perform.

Now to know how many times the Divisor to deduct the first time, I consider what part or places of the Dividend I can take the Divisor from, and find it the five first towards the left hand; therefore I mark that, by putting a Point under it, and I consider how often

often the Diviſor can be had in thoſe five places, or how often 4 (the firſt of one) in 9 (the firſt of the other) and find it 2 times. Now to know what Denomination to give this (2) I conſider what place that Figure which I made the Point under poſſeſſeth, which being the Hundred thouſands, therefore this 2 is 200000: ſo that multiplying the Diviſor by 200000, and deducting the Product from the Dividend, the Remainer is 74094321o, which is an abſolute new Dividend, to be divided by 45678 the Diviſor. So having repeated the Work by the ſame Rules, at laſt a Number leſs than the Diviſor remains, ſo the Work is ended.

And thus by dividing the whole into 6 diſtinct Dividends, there ariſeth 6 Quotients; the Sum of which is the general or true Quotient.

But becauſe Brevity is moſt commendable in this Art, therefore all ſuperfluous Figures being omitted, as the repeating of the Diviſor, the Cyphers at the ends of the Quotients and Subtrahends, the Work is then the ſame as in the two firſt Propoſitions: And if the whole Subtrahends be omitted to be put down, deducting as you gradually multiply the Diviſor by the Figure put in the Quotient, the Work is then contracted as much as may be, and will ſtand as in the Example under the ſecond Way of Diviſion.

The Tarif ſhews you by Inſpection how often the Diviſor can be had in each Dividend (without trial or gueſſing) and the Digits towards the left hand ſhew what muſt be put in the Quotient.

The Uſe of Diviſion.

Farthings, Pence, or Shillings, are immediately reduced into Pounds, by dividing the given Number by 960, 240, or by 20, (as by the ſecond Table in Addition.)

In 157460 Shillings how many Pounds? Cut off Units place, and take half the remaining Figures toward the left hand; and where the Number to be halfed is odd, take the leſs half, and put 10 to the next Figure, *&c.* Thus $\frac{1}{2}$ of 157460 is *l.* 7873.

In 1889520 Pence how many Pounds?

l.

240) 1889520 (7873 Anſwer.
| ...|
209
175
072
0

In 7558080 Farthings how many Pounds?

l.

960) 7558080 (7873 Anſwer.
| ....|
838
700
288
0

Note,

Note, Farthings are reduced into Pence by dividing by 4, and Pence into Shillings by dividing by 12.

In 7558991 Farthings, how many Pounds, Shillings, Pence, and Farthings? *d.* *s.* *l.* *s.* *d.*

4) 7558991 (1889747 (157478 (7873 : 18 : 11 ¾ Anſwer.
12) 20)

35 68

38 57

29 94

19 107

31 11 Pence reſt.

3 Farthings reſt.

Shillings are made Pounds by the above Rule of halfing.

Example 5. In 3046400 Ounces, how many Ton?

Ounces in a Ton *per* Table 1. in Addition, } 35840) 3046400 (85 = Ton Anſwer.

17920

0

Example 6. In 158256 Quarts, how many Ton of Wine?

Quarts in a Ton *per* Table 3. } 1008) 158256 (157 = Tons of Wine, Anſwer.

5745

7056

0

Theſe ſix Examples are the Reverſe, and prove the Truth of the ſix firſt in the Uſe of Multiplication.

And as a ſeventh Example, I ſhall give the Uſe of Multiplication and Diviſion, in ſhewing how to find all the aliquot Parts into which any Number is capable of being divided: and the Uſe thereof.

Exam-

Example 1.] To find how many even Parts into which 360 is diviſible. See the whole Operation.

2) 360	The Diviſors and laſt Quote	= 2, 2, 2, 3, 3, 5,
2) 180		— 4, 8,
2) 90		6, 12, 24, 9,
3) 45		18, 36, 72,
3) 15		10, 20, 40, 15,
5		30, 60, 120, 45,
		90, 180, 360.

1. I divide the given Number by 2, 3, 5, 7, or other that will divide without a Remainer, and then place the Diviſors and laſt Quote as in the Example.

2. I multiply the 2 next the left hand by the next 2, which produceth 4, placed under the 2, and that Product by the firſt 2 gives 8.

3. I multiply the 3d (2) the 4, 8, and 2d (3) by the 1ſt 3, which produceth 6, 12, 24, and 9 placed under the reſpective Multiplicands, (as I do all the reſt following.)

4. In like manner I multiply 6, 12, and 24, by the 3, (becauſe that Digit is repeated, otherwiſe I ſhould have multiplied the 2, 2, 2, 3, and the 4, 8, alſo by it) and the Products are 18, 36, and 72.

5. I multiply all that is before by 5, (except where the Products would be the ſame) as 2, 4, 8, and 2d (3) in the firſt and ſecond Lines, which produceth 10, 20, 40, 15, in the fifth Lines. Alſo by the ſame 5 (next the right hand) I multiply 6, 12, 24, and 9, which produceth 30, 60, 120, and 45 in the ſixth Line, and 18, 36, and 72 in the fourth Line (of the Numbers above) by the ſame 5 produceth 90, 180, and 360.

And if there were any more different Digits in the firſt Line towards the right hand, I ſhould multiply all the above 7 Lines thereby, (where the Products would not be the ſame, for I omit repeating one and the ſame Product.) But becauſe the laſt Number is 360, and cannot therefore be properly ſaid to be a part of the Number given, I therefore omit that, and put 1 always inſtead of the Number given.

And tho you change the places in the Figure in the firſt Line, the Anſwer will be true; as in the ſubſequent Example will appear, as

by the above Rules the aliquot Parts in the laſt Example of 360 are found 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, and 180.

Example 2.] To find all the aliquot Parts into which 10350 may be divided.

10350 divided by 2 = 5175; that by 3 = 1725; that by 3=575; that by 5=115; that by 5=23.

Which Diviſors and the laſt Quote are } 3, 3, 2, 5, 5, 23 (the 2 being tranſpoſed)

9, ...	=3 by the 3.
6, 18, ...	=3, and 9 by the 2 in the upper Line.
15, 45, 10, ...	=3, 9 and 2 by 5 in the upper Line.
30, 90, ...	=6 and 18 by 5.
75, 225, 50, 25,	=alſo the 15, 45, and 10 by ſaid 5; it being repeated.
150, 450,	=30 and 90 by 5, for the ſame reaſon.
69, —, 46, 115,	=3, 2 and 5 in 23, the firſt in the upper Line.
207,	=9 in 2d Line by ſaid 23.
138, 414,	=6 and 18 in the 3d Line by ſaid 23.
345, 1035, 230,	=15, 45, and 10 in the 4th Line by 23.
690, 2070,	=30 and 90 in the 5th Line by the 23.
1725, 5175, 1150, 575,	=the 6th Line by 23, the firſt Number in the firſt Line.
3450, 10350.	=150 and 450 in the 7th Line by ſaid 23.

So the even Parts of 10350 are 1, 2, 3, 5, 6, 9, 10, 15, 18, 23, 25, 30, 45, 46, 50, 69, 75, 90, 115, 138, 150, 207, 225, 230, 345, 414, 450, 575, 690, 1035, 1150, 1725, 2070, 3450, and 5175.

The Uſe of the Rules for finding the aliquot Parts of a Number.

This will appear thus: Suppoſe I would find all the aliquot Parts of a Pound Sterling, I reduce it to its leaſt Denomination, as 960 Farthings; the aliquot Parts of which are found 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 32, 40, 48, 60, 64, 80, 96, 120, 160, 192, 240, 320, 480, and 960.

Which Numbers being made Denominators, and 1 the Numerator, there will ariſe the Parts of Coin following; which being ſuppoſed the Price of any Integer, the Value of any Number of them is found by dividing the Number of Integers by the reſpective Denominators at once.

2,	2,	2,	2,	2,	2,	3,	5.
—	4	8	16	32	64.		
6,	12,	24,	48,	96,	192.		
10,	20,	40,	80,	160,	320,	15,	
30,	60,	120,	240,	480,	960.		

Parts of a Pound.	*s.*	*d.*	*Parts.*	*s.*	*d.*	*q.*	*Parts.*	*d.*	*q.*
$\frac{1}{2}$	10	—	$\frac{1}{10}$	1	3		$\frac{1}{80}$	—	3
$\frac{1}{3}$	6	8	$\frac{1}{20}$	1	—		$\frac{1}{96}$	—	2	2
$\frac{1}{4}$	5	—	$\frac{1}{24}$	—	10		$\frac{1}{120}$	—	2	—
$\frac{1}{5}$	4	—	$\frac{1}{30}$	—	8		$\frac{1}{160}$	—	1	2
$\frac{1}{6}$	3	4	$\frac{1}{32}$	—	7	2	$\frac{1}{192}$	—	1	1
$\frac{1}{8}$	2	6	$\frac{1}{40}$	—	6	—	$\frac{1}{240}$	—	1	—
$\frac{1}{10}$	2	—	$\frac{1}{48}$	—	5	—	$\frac{1}{320}$	—	—	3
$\frac{1}{12}$	1	8	$\frac{1}{60}$	—	4	—	$\frac{1}{480}$	—	—	2
$\frac{1}{15}$	1	4	$\frac{1}{64}$	—	3	3	$\frac{1}{960}$	—	—	1

Example 1. What doth 7358 amount to, at 1*d.* 1*q.* each?

192) 7358 (38*l.* 6*s.* 5 *d.* $\frac{1}{4}$ = Anſwer.
1598
62 reſt ſo many 5 Farthings, or 6*s.* 5 *d.* $\frac{1}{4}$.

Example 2. What doth 31987 come to at 3 *d.* 3 *q.* each?

64) 31987 (499 *l.* 15 : 11 : 1 = Anſwer.
638
627
Reſts 51 being ſo many 3*d.* 3*q.* or 15*s.* 11 : 1

Note, 1 *d.* 1 *q.* in the firſt is $\frac{1}{192}$, and 3 *d.* 3 *q.* in the ſecond Example, is $\frac{1}{64}$ of a Pound.

The

The Proof of Multiplication.

This can only be done by Division: as in any of the 6 Examples foregoing, the Products of those in the Use of Multiplication are proved to be true by dividing those Products by the Multiplyer, the Quotient is the Multiplicand; or if you divide the Product by either of the Factors, the Quotient will be the other. But to pretend to prove Multiplication by casting out the Nines, is a Mistake, as I have elsewhere demonstrated; for why divide by 9 more than 2 or any other Digit, which would prove the Work as well? But the easiest way is to divide the Factors by 10, and the Product of the Remainers by 10, which will leave a Remainer equal to that of the Product divided by 10. But the mischief is, that if there be a Mistake in the Product of just your Divisor, or any Power thereof, this Way of proving will not shew it.

The Proof of Division.

This is either performed by Multiplication or Division, as appears in the Margin. For Example, I have divided 17002125 by 357, and find the Quotient 47625. And if 17002125 be divided by that Quotient, the latter Quotient will be 357 = the former Divisor. This is proved by Multiplication of the Quotient 47625 by 357 the Divisor. See *Exam.* 2. *Prop.* 2. of *Sect.* 4.

357) 17002125 (47625	17002125 (357 = Quotient
2722	271462
2231	333375
892	0
1785	
0	

Sect. VI. *Of Extracting the Roots of Numbers, called Evolution.*

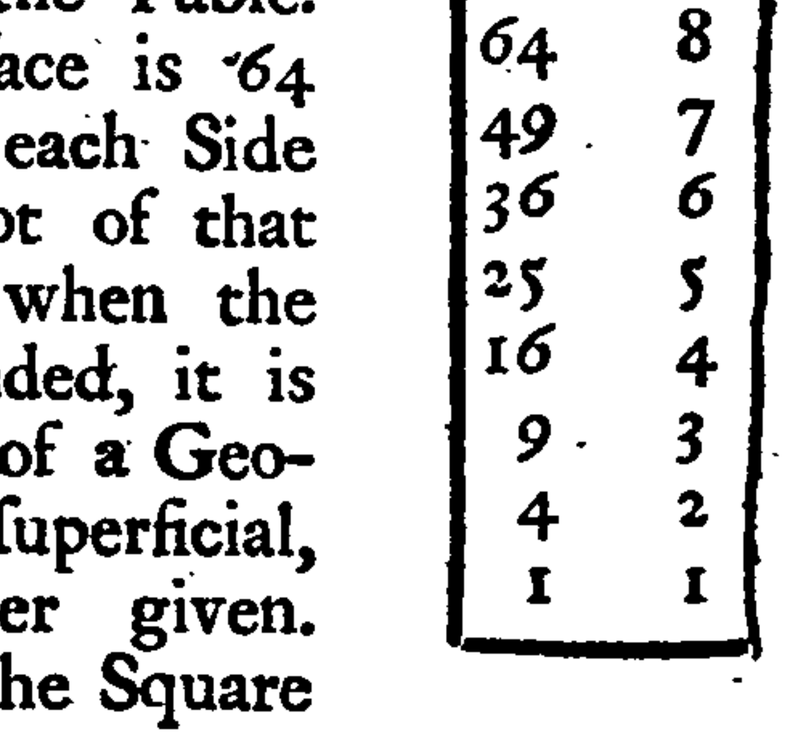
IN this Section I shall shew,
I. The Extraction of the Square Root.
II. The Extraction of the Cube Root.
III. The Extraction of the Biquadrate Roots of Numbers.

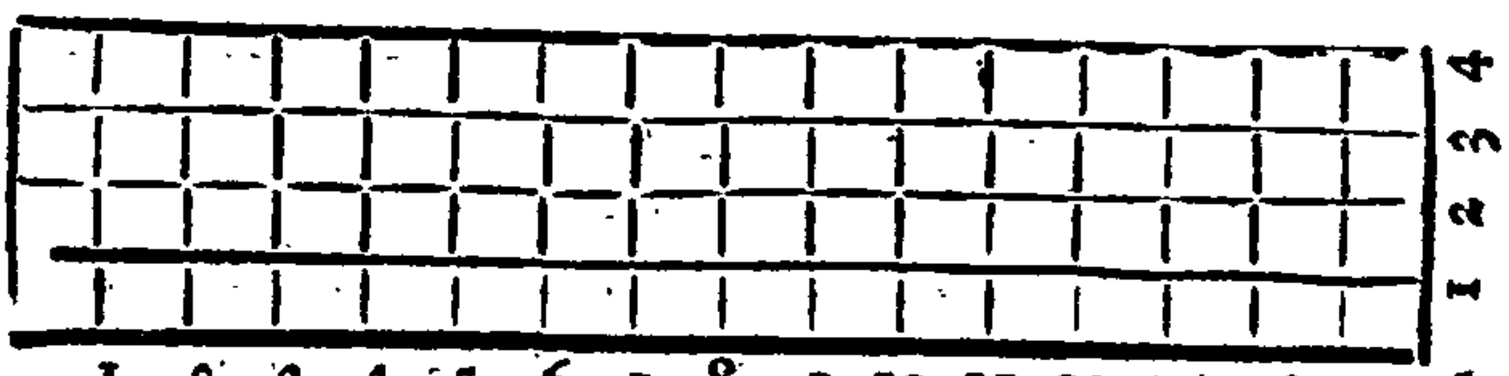
I. The

I. The Square Root of a Number is ſuch a one, as being multiplied in itſelf, produceth the Number given; (for to ſquare any Number, is to multiply it by itſelf.) Thus the Square Numbers, whoſe Roots are the 9 Digits, are as follows in the Margin.

Squares.	Their Roots.
81	9
64	8
49	7
36	6
25	5
16	4
9	3
4	2
1	1

This may be illuſtrated by any ſquare Superficies, as Glaſs, Board, *&c.* for if the ſuperficial Content of a Square thereof (whoſe 4 Sides are equal) be 81, then one of the 4 Sides is 9; if the ſquare Superficies be 64, then 1 of the 4 equal Sides is 8, *&c.* as appears by the Table. And the ſquare Figure whoſe Surface is 64 ſquare Inches, Feet, or other thing; each Side is therefore 8, which is called the Root of that Superficies, as you ſee. So that when the Square Root of any Number is demanded, it is as much as to require what the Side of a Geometrical Square is, whoſe Area (or ſuperficial, or outſide Content) is any Number given. Hence it follows, that by extracting the Square Root of any Superficies, you reduce it to a compleat (or Geometrical) Square. Thus the long Quadratick Figure being 16 in length, and 4 in breadth, the Superficies is upon the flat 64, (or 4 times 16) and the ſquare Root of 64 by the Table above is 8. Therefore a Geometrical Square, one of whoſe four equal Sides is 8, (as that above) is equal to the long Square, or any other Figure whoſe flat Surface is 64.





Such Numbers as the above, when the Root may be extracted without a Remainer, may be called compleat or perfect ſquare Numbers; but there are abundantly more Numbers, whoſe Roots cannot be preciſely extracted: and theſe are called imperfect Squares, or Surd Numbers, of which more in Decimals, Logarithms, and eſpecially in Algebra, hereafter treated on.

Queſtion

Queſtion 1. What is the Square Root of 10274589?

Place the Number ſo that you may conveniently perform the Work, and point over the firſt and every ſecond afterward; which Points ſhew how many places the Roots will conſiſt of.

```
. . . . . Root
10|27|45|89|16 (32054
 :  :  :  :
6) 127
640)  34589
6410)   256416
                0 remains.
```

Then conſider what ſquare Number in the foregoing little Table is next to and can be taken from the firſt Branch towards the left hand of the ſquare Number given, (as here 10;) 9 I find is the next, whoſe Root (3) I put down (like a Quotient) as you ſee, and ſubſtracting the Square of 3 (or 9) from 10, there remains 1.

To which Remainer 1 I bring down the two next Figures (27) and divide that 127 (except the Figure next the right hand) by 6, which is double the Root (3) ſaying the 6's in 12 is 2; put that in the Root, makes it 32. Then ſquare 2, and deduct from 7, (in the 127) and the reſt is 3; then multiply 6, the double Root, by 2, and deduct the Product from 12 (in the 127) and there reſts 0. The reſt is only Repetition.

Then double the Root 32 makes 64, and that is your next Diviſor. Then to the 3 bring down the next Branch 45, marking it as you do in Diviſion, and you have 345 for a Dividend.

But becauſe (if Units place, here 5, be excluded) you cannot have 64 in the reſt, which is 34; therefore put (0) in the Root, and alſo in the Diviſor, (to 64, as you ſee) and bring down the next Branch 89, makes a Dividend 34589 to divide by 640. And finding I can have 6 in 34, 5 times, I put 5 in the Root; and ſquaring 5 (as was taught for the other Figures of the Root) I ſay 25 from 29, (of the 34589) and there reſts 4, and carry 2; 5 times 0 is 0, but 2 from 8 reſts 6, and ſo 5 times 4, proceed as in Diviſion, and the whole Remainer is 2564.

Laſtly, To this bring down the laſt Branch (16) and divide the 256416 by double the Root 3205, *viz.* 6410, and the Quote being 4, I put it in the Root, and ſubſtracting the Square thereof from 16, (in the 256416) and alſo the Product of the Diviſor thereby, as before ſhewn, there remains (0) and 32054 is the Anſwer.

A ſecond Example.

	Square Root.
1 14 73 25 96 43	(107113
20) 1473	
214) 2425	
2142) 28496	
21422) 707543	
64874 reſts.	

A third Example.

	Square Root.
97 65 43 21 01 23	(988202
18) 1665	
196) 16143	
1976) 39921	
197640) 3970123	
17319 reſts.	

II. *The Extraction of the Cube Root.*

The Cube Root of any Number is that whoſe Square multiplied by the Root, produceth the Cube Number given. Thus the Cube Numbers, whoſe Roots are the 9 Digits, are as follows.

Cube Numbers.	Squares.	Roots of the Squares and Cubes.
1	1	1
8	4	2
27	9	3
64	16	4
125	25	5
216	36	6
343	49	7
512	64	8
729	81	9

A Cube is a ſolid Body bounded by ſix Geometrical ſquare Superficies's, as a Dye, whoſe Length, Breadth, and Depth, (or Thickneſs) are all equal: And to extract the Cube Root of any Number, is to ſuppoſe that Number the Content of a Cube in Feet, Inches, *&c.* given, to find the Side of one of the ſix Squares that bounds it. So that as the Extraction of the Square Root is chiefly uſed in meaſuring and proportioning of Surfaces; ſo is the Cube Root in doing that of Solids. And as there are Surd Numbers, whoſe Square Roots cannot be extracted without a Remainer, ſo it is in Cube, and other Roots.

I ſhall give but one Example, but 'tis ſo plainly demonſtrated, as may be ſufficient to enable any one to extract the Root of any whole Number: And where there are Remainers, I ſhall ſhew how to proceed, when I ſhew the Uſe of Decimals in extracting the Cube Root.

What is the Cube Root of 3293416809346 4? The whole Operation follows, with the Name of each Line or how it ariſeth.

```
                .   .   .   .   .
32 934 168 093 464 (32054 = Cube Root fought.
27                 ..... The Cube of 3 (1ſt in the Root) Deduct.
279) 5934          ..... The firſt Reſolvend or Dividend.
      9            ..... The treble Root (3).
     27            ..... Treble the Square of that 3.
     279           ..... Sum, or the firſt Diviſor.
       8           ..... Cube of 2, the ſecond put in the Root.
      36           ..... Squ. of that 2, multip. in laſt treb. Root.
      54           ..... The treble Square of the Root in 2.
     5768          ..... The Sum of the 3 laſt Lines = a Subtrah.
30816) 166168      ..... { The 2d Reſolvend, being 166, the Rem.
                         { and 168 carry'd down to that.
      96           ..... Treble the Root 32.
    3072           ..... Treble the Square of that Root.
   30816           ..... Sum, or the 2d Diviſor.
3072960) 16616809  ..... The 3d Reſolvend.
     960           ..... Treble the Root 320.
  307200           ..... Treble the Square of that Root.
 3072960           ..... Sum, (or the 3d Diviſor.)
     125           ..... Cube of 5 (laſt put in the Root.)
   24000           ..... Square of that 5, in the laſt treble Root.
 1536000           ..... Laſt treble Square of the Root in that 5.
15384012 5         ..... The Sum, or a Subtrahend.
30817036 5) 1232796846 4  The 4th Reſolvend.
    9615           Treble the Root 3205.
  30816075         Treble the Square of that Root.
  30817036 5       Sum, (or the 4th Diviſor.)
        64         The Cube of 4, laſt put in the Root.
    153840         Square of that 4 in the laſt treble Root.
 123264300         Laſt treble Square of the Root in that 4.
1232796846 4       { The Sum (or Subtrahend) which de-
                   { ducted from the laſt Reſolvend,
(0) reſts.
```

The Steps in the Performance of the Work of Extraction of th
Cube Root are very evident in this laſt Example: For,

1. Yo

1. You point over the Figure in Units place, and then over every third Figure, which divides the whole Cube Number into 5 parts; which ſhews that the Root will conſiſt of 5 places.

2. I find that 3 being cubed, produceth 27, (as appears by the little Table foregoing) which is the next leſs Cube Number to 32, (the firſt part towards the left hand) I therefore put the Root 3, in the Cube Root ſought as you ſee, and deducting the 27 from 32, the Remainer is 5.

3. To the Remainer we always bring down the next part, (as here 934) and that makes the Reſolvend, which is always the Dividend, in order to find the next Figure in the Root.

4. And to find the Diviſor whereby to divide that Dividend, you may obſerve that it is always compoſed of the treble Root, *i. e.* 9, and of the treble Square of the Root, *viz.* 27.

5. I find I can have 279 the Sum, in 593 (for the 4 in Units place of the Reſolvend 5934, you are in this caſe to take no notice of) 2 times, which put in the Root makes it 32.

6. The next thing is to frame your Subtrahend, which is always compoſed, 1*ſt*, Of the Cube of the Figure laſt put in the Root: 2*dly*, The Square of that Figure multiplied in the laſt treble Root: And, 3*dly*, The laſt treble Square of the Root multiplied in the ſaid Figure laſt put in the Root: the Sum of which three Numbers, as the Example plainly ſhews, is the Subtrahend.

7. The Subtrahend muſt always be deducted from the laſt Reſolvend, as here 5768 from 5934, and the Remainer is 166; to which bring down (as before) the next three Figures (168) and you have a new Dividend (or Reſolvend:) all the reſt is Repetition of the ſame Method of working; except here, that you cannot have 30816 in 16616, therefore you put a (0) in the Root, and from that 320 (the Root) you make a new Diviſor, which is 3072960; and for the Dividend, you bring down the 3 next Figures (093) to the laſt Reſolvend, and that makes your Dividend 166168093, *&c.* which is all very obvious in the Example.

III. *The Extraction of the Biquadrate Root.*

The Biquadrate Root is the Root of the 4th Power, as the Cube is that of the 3d, and the Square Root that of the 2d Power, according to the following Table.

Whence it appears, that the ſecond Power of any Number is the Square of it, or Product of any Number by itſelf; the Cube

or 3d Power is produced by multiplying the Square of any Number by its Root; the Biquadrate or 4th Power is discovered by multiplying the Cube by the Root, as appears in these nine Examples.

But of the Powers of Numbers to the 10th inclusive, and the proper Name of each, you have a full Account in the Extraction of Roots in Algebra; where the Reason of that abstruse Method of extracting the Square, Cube, Biquadrate, Surfolid, *&c.* Roots, is fully explained from the Algebraical Canons for each, both by Numbers and Symbols.

What is the Biquadrate Root of 2998219536?

The Example, with Rules how each Line is produced, follows.

A Table of Powers and their Roots.

The 4th Powers.	The Powers.	The Powers.	The 2d, Powers.
1	1	1	1
16	8	4	2
81	27	9	3
256	64	16	4
625	125	25	5
1296	216	36	6
2401	343	49	7
4096	512	64	8
6561	729	81	9

The Biquadrate or 4th Powers. The Cubes or 3d Powers. The Squares or 2d Powers. The Root or first Power, *viz.* of the 2d, 3d, and 4th Powers.

1. You see that having pointed over Units place, and every 4th place afterwards, the Root will consist of 3 places, as there are 3 points.

2. You must consider what 4th Power in the little Table above is next to and less than the first Part or Branch 29: you see 16 is, whose Root you have there (2); then subtracting the Biquadrate 16 from 29, there rests 13.

3. To that 13, bring down the next Branch or Part 9821, and you have 139821 for a Dividend, of which the Units place must not be considered, in asking how often the Divisor can be had therein.

4. To find the Divisor, you see it is composed, 1*st*, Of 4 times the Figures then in the Root, (as here 2.) 2*dly*, Of 6 times the Square of that: And, 3*dly*, 4 times the Cube thereof: the Sum of which being a Divisor,

5. There ariseth from the Division, 3 in the Root.

6. You must find a Subtrahend, by adding together as the Directions against the 4 Numbers 81, 216, 216, and 96, do express; and subtracting the Sum from the last Resolvend, there rests 19980: to which bringing down 9536, you have 199809536. The rest is only Repetition of the three last Steps, as to Method.

	29 9821 9536	(234 = the Biquadrate Root ſought.
	16	The Biquadrate of 2, 1ſt put in the Root.
3448)	139821	13 (the Remainer) and 9821 brot. down to it, being the 1ſt Reſolvend or Dividend
	8	4 times the 2 put firſt in the Root.
	24	6 times the Square of that 2.
	32	4 times the Cube of that 2.
	3448	The Sum of theſe 3, a Diviſor.
	81	The Biquadrate of 3, the laſt in the Root.
	216	4 tim. the 2 in the Cube of the 3, in the Root.
	216	6 times the Square of 2, in the Square of 3.
	96	4 times the Cube of 2, in 3.
	119841	The Sum, or a Subtrahend to take from the laſt Reſolvend above.
4898632)	19980 9536	A 2d Reſolvend, or Dividend.
	92	4 times the 23 in the Root.
	3174	6 times the Square of 23.
	48668	4 times the Cube of that 23.
	4898632	The Sum of the 3 Lines, a 2d Diviſor.
	256	The Biquadrate of 4, the laſt in the Root.
	5888	4 times 23, in the Cube of 4 in the Root.
	50784	6 times the Squ. of that 23, in the Sq. of the 4.
	194672	4 times the Cube of that 23, in the ſaid 4.
	19980 9530	Sum = a Subtrahend, which taken from the Reſolvend laſt above,

(o) remains.

I know that the Biquadrate Root is the Square Root of the Square Root, and conſequently may be performed by extracting the Square Root twice. But this ſeems a more natural way to perform it, as the Extraction of the Cube, Surſolid Root, &c. may be done from Algebraic Canons, and I have inſerted the Method here, becauſe to me it is new; for I never ſaw, nor heard of its being done thus before: and I was pleaſed when I conſidered it from the 4th Power of $a + b$ in Algebra, which wonderfully, tho plainly, points out all theſe Rules above, which ſeem ſo intricate, as to be impoſſible firſt to diſcover. This Extraction of the Biquadrate Root is uſeful in

ſome

ſome Computations of Compound Intereſt; finding 3 mean Proportionals between 2 Extremes, as in the 5th Head of Geometrical Progreſſion, &c.

The Proof of the Square Root (as appears from the little Table to it) is to multiply the Root in itſelf; the Proof of the Cube is to multiply that Square in the Root; and of the Biquadrate to multiply the Cube in the Root: for they reſpectively produce the Number given to have the Root extracted, provided that nothing remain; and if any thing do, add ſuch Remainer.

CHAP. II.

Contains the Application of the Fundamental Parts of Arithmetic, to Vulgar Fractions, Progreſſion, the Rules of Proportion, Practice, Loſs and Gain, Fellowſhip, Barter, Exchange, Equation of Payments, Alligation, and Rules of Falſe Poſition, in eleven Sections.

SECT. I. *Of Vulgar Fractions.*

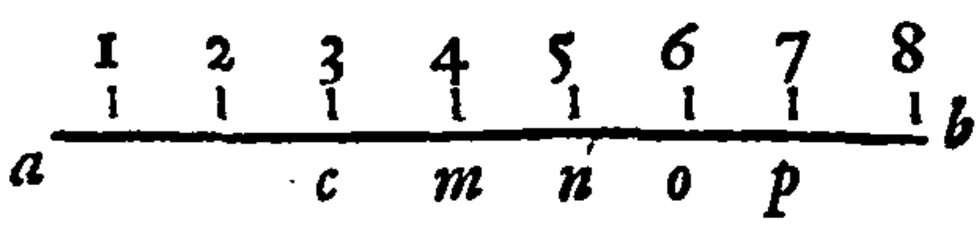
I. NOTATION *and Numeration,*] Teacheth what a Fraction is, and how to read or write down any one.

By a Fraction here is meant a broken Number, that is to ſay, one or more Parts of a Unit; for as there is Infinity of Units, ſo a Unit may be, or be ſuppoſed to be, divided into any Number of Parts.

A Fraction conſiſts of two Parts, a *Denominator*, and a *Numerator*: The former ſhews how many Parts the Unit is divided into, which is wrote below the Line; the latter ſhews how many of thoſe Parts are contained in the Fraction, which is wrote above the Line; as $\frac{3}{4}$ of

$\frac{3}{8}$ of a Pound Sterling, or 7*s.* 6*d.* here $\frac{3}{8}$ is the Numerator. $\frac{3}{8}$ the Denominator. And theſe 2 Parts are called the Terms of a Fraction.

Or, to be more plain yet; the Line (*a b*) repreſents 1 or a Unit divided into 8 parts, and doth repreſent the ſaid Denominator of the Fraction given; and the Line (*a c*) is 3 of thoſe 8 Parts; (*a m*) = 4 Eights or $\frac{4}{8}$; (*a o*) = $\frac{6}{8}$; (*a p*) = $\frac{7}{8}$, *&c.*



Having thuſhewn what a Fraction is, you are next to know how to read it; and that is, by firſt mentioning the Numerator, and then the Denominator. As by this Example you ſee where 1|12th of the Unit (or Line *m n*) is wrote thus $\frac{1}{12}$, and read One Twelfth, *&c.* $\frac{2}{12}$ = 2 Twelfths, *&c.* But the Line might more commodiouſly be made downright, and then Fractions would ſtand as in the Examples next the left hand, whereby a Line in printing might often be gained, if $\frac{1}{12}$ were wrote 1|12; $\frac{2}{12}$, 2|12, *&c.* But let Cuſtom have its own way; and then Fractions are wrote and read as in the foregoing Tabulet, and by the ſame Rule $\frac{17}{25}$ is ſeventeen 25th Parts; $\frac{365}{1728}$ is 365, ſeventeen hundred and 28 Parts; that is, if a Unit were divided into 1728 Parts, this Fraction does contain 365 of thoſe Parts.

A Table of Simple Fractions.

m	Read thus,
1--12th, wrote thus $\frac{1}{12}$	One Twelfth.
2--12ths, ... $\frac{2}{12}$ ..	Two Twelfths.
3--12ths, ... $\frac{3}{12}$	Three Twelfths.
4--12ths, ... $\frac{4}{12}$ ..	Four Twelfths.
5--12ths, ... $\frac{5}{12}$	Five Twelfths.
6--12ths, ... $\frac{6}{12}$ ..	Six Twelfths.
7--12ths, ... $\frac{7}{12}$	Seven Twelfths.
8--12ths, ... $\frac{8}{12}$ ..	Eight Twelfths.
9--12ths, ... $\frac{9}{12}$	Nine Twelfths.
10--12ths, ... $\frac{10}{12}$ ..	Ten Twelfths.
11--12ths, ... $\frac{11}{12}$	Eleven Twelfths.
12--12ths, ... $\frac{12}{12}$ or 1.	Twelve Twelfths.
n	

But there are various kinds of Fractions, as Proper, Improper, Simple, and Compound.

A Proper Fraction is one whoſe Numerator is leſs than the Denominator, as thoſe above.

An Improper Fraction is when the Numerator is greater or equa to the Denominator, as $\frac{7}{3}$, $\frac{7}{7}$, *&c.*

A Simple or Single Fraction, as any of thoſe foregoing is immediately the Fraction of a whole Unit. But

A Compound Fraction is a Fraction of a Fraction, or Part of another Part of a Unit, as $\frac{2}{3}$ of $\frac{3}{4}$, or $\frac{3}{5}$ of $\frac{9}{10}$, *&c.* and is illuſtrated in the following Examples.

Where the whole Line (*l n*) is divided into 10 equal Parts, and each of thoſe are ſubdivided into two Parts: ſo that ſuppoſing the Unit (*l n*) to be 1 *l.* each 10th is 2 *s.* and every half of a 10th is 1 *s.* ſo that $\frac{1}{10}\frac{3}{4}$ of $\frac{7}{10}$ is a Fraction of a Fraction, whoſe Value is 13 *s.* But the Value here is not intended to be ſo obſervable as the Nature of the Compound Fraction; for here $\frac{7}{10}$ is $\frac{7}{10}$ of the Line *l n*, and $\frac{1}{10}\frac{3}{4}$ of $\frac{7}{10}$ is 13 *s.* for $\frac{1}{10}$ is 2 *s.* and conſequently $\frac{7}{10}$ is 14 *s.* and $\frac{1}{10}\frac{3}{4}$ of 14 *s.* muſt needs be 13 *s.* Sometimes you have a Fraction of a Fraction of a Fraction, *&c.* of a Unit, as 1 Farthing is $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound, *&c.*

Having thus ſhewn what a Fraction is, and how to read the ſame, I proceed to

A Table of Compound Fractions.

l		*s.*
	$\frac{1}{2}$ of $\frac{1}{10}$ of 1 *l.* or	1
1	10 or	2
	$\frac{3}{4}$ of $\frac{2}{10}$	3
2	10	4
	$\frac{5}{6}$ of $\frac{3}{10}$	5
3	10	6
	$\frac{7}{8}$ of $\frac{4}{10}$	7
4	10	8
	$\frac{9}{10}$ of $\frac{5}{10}$	9
5	10	10
	$\frac{1}{1}\frac{1}{2}$ of $\frac{6}{10}$	11
6	10	12
	$\frac{1}{1}\frac{3}{4}$ of $\frac{7}{10}$	13
7	10	14
	$\frac{1}{1}\frac{5}{6}$ of $\frac{8}{10}$	15
8	10	16
	$\frac{1}{1}\frac{7}{8}$ of $\frac{9}{10}$	17
9	10	18
	$\frac{1}{2}\frac{9}{0}$ of $\frac{1}{1}\frac{0}{0}$	19
10	10	20
n		

II. *Reduction of Vulgar Fractions.*

This Rule muſt neceſſarily be taught before Addition and Subſtraction, becauſe they cannot be performed till the Fractions given to be added or ſubſtracted, are fitted by Reduction for that purpoſe.

Caſe 1. *To reduce a mix'd Number to an Improper Fraction.* As for *Example* $12\frac{3}{7}$.

Rule.] Multiply the intire Part by the Denominator of the Fraction, and to the Product add the Numerator (3), and the Sum

placed over the Denominator (7) is the Anſwer, and will ſtand thus $\frac{87}{7}$.

Caſe 2. *To reduce an improper Fraction to a whole or mix'd Number. Example*, reduce $\frac{87}{7}$.

Rule.] Divide the Numerator (87) by (7) the Denominator, and the Quotient is the intire Number, and the Remainer (3) is the Numerator to place over the Denominator (7); ſo the Anſwer is $12\frac{3}{7}$, and proves the firſt Caſe true. And by the ſame rule $\frac{36}{5}$ is $= 7\frac{1}{5}$; $\frac{144}{12}$ is $= 12$; $\frac{81}{9}$ is 9; $\frac{44}{11}$ is 4, *&c.*

Caſe 3. *To reduce Compound Fractions to Simple.*

Example. Reduce $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{7}{8}$ into one ſimple Fraction.

Rule.] Multiply the Numerators together for a new Numerator, and alſo the Denominators together for a new Denominator, and it ſtands thus $\frac{42}{96}$; or this is $\frac{1}{2}$ of $\frac{7}{8}$ or $\frac{7}{16}$, by changing the Parts of the firſt and ſecond Fractions, and omitting thoſe which are the ſame; (as 3 in each) and $\frac{847}{2240}$ of $\frac{1}{2}$ of $\frac{12}{15}$ of $\frac{3}{4}$ is $\frac{612}{2880}$.

The Truth of this Rule is eaſily *proved* from any ſelf-evident Inſtance, as $\frac{1}{2}$ of $\frac{2}{3}$ of a Pound Sterling is *6 s. 8 d.* ſo by the Rule it is $\frac{2}{6}$. Now $\frac{1}{6}$ being *3 s. 4 d.* $\frac{2}{6}$ muſt be *6 s. 8 d.* or $\frac{1}{2}$ of $\frac{2}{3}$ is $\frac{1}{3}$: And if the Parts be changed, and the two of a ſort be omitted, it proves the ſame; and the Reaſon is plain, for the Terms of a Fraction multiplied by the ſame Number, does not increaſe or alter the Value of ſuch Fraction.

Caſe 4. *To reduce a Fraction to its loweſt Terms.*

Example. Reduce $\frac{36}{45}$ to its loweſt Terms.

Rule 1.] Divide the Parts of the Fraction by any Number that will divide both without a Remainer: ſo this $\frac{36}{45}$ is reduced to $\frac{4}{5}$, for Anſwer.

Rule 2.] Divide the greater by the leſſer Part of the Fraction, and if any thing remain, divide the laſt Diviſor by that; and if any thing yet remain, divide the laſt Diviſor by that, till nothing remain; and then the laſt Diviſor divideth both Parts of your Fraction, ſo as to reduce it to its loweſt Term. See the Work in the Margin, where 9 the laſt Diviſor reduces $\frac{36}{45}$ to $\frac{4}{5}$; ſo $\frac{1440}{2073}$ is $\frac{10}{143}$; $\frac{84}{96}$ is $\frac{7}{8}$; and $\frac{315}{420}$ is $\frac{3}{4}$, and $\frac{140}{105}$ is $\frac{4}{3}$, 35 dividing both Parts of the Fraction; found as *per* the 2d Rule.

for $\frac{36}{45}$ divided by 3 is $\frac{12}{15}$, and $\frac{12}{15}$ divided by 3 is $\frac{4}{5}$

36) 45 (1
9) 36 (4
0

The Truth of this Rule: That a Fraction reduced to its loweſt Terms is of the ſame Value with that given, is thus *proved*; $\frac{2}{3}$ of a Pound in its loweſt Terms is $\frac{2}{3}$ of a Pound, or 13 *s.* 4 *d.* And $\frac{1}{4\frac{1}{2}}$ of a Pound being 20 *d.* 8 times that is 13 *s.* 4 *d.*

Caſe 5. *To find the Value of any Fraction of Weight*, &c.

Example. What is the Value of $\frac{3}{4\frac{1}{2}}$ of a Pound Averdupois?

Rule.] Multiply the Numerator of the Fraction by ſuch a Number of Units of the next leſs Denomination, as is equal to a Unit of that name which the Fraction is of, and divide the Product continually by the Denominator, and the Quotient or Quotients anſwer your Queſtion. See the Work of the following Examples.

Example 2. What is the Value of $\frac{17}{26}$ of a Pound Sterling?

17 Numerator
20 Shill. in 1 *L.* } Mult.

26) 340 (13 *s.*

80

2 remains ſhil.
12 Pence in 1 *s.* } Mult.

26) 24 (0 *d.*

4 Farth. in 1 *d.* Mult.

26) 96 (3 $\frac{9}{13}$ Farthings.

18

So the Anſwer is
s. *d.* *qr.*
13 : 0 : 3 $\frac{9}{13}$

Example 1. to *Caſe* 5.

31 Pounds wt.
16 Ounces in 1 lb.

186
31

42) 496 (11 Ounces.

76

34 remains.
16 Drams in 1 Oun. multiply.

204
34

42) 544 (12 Drams.

124
40 remains to place over the 42

So the Anſwer is
Oun. *Dram.*
11 : 12 $\frac{40}{42}$ or $\frac{20}{21}$.

And by the ſame Rule any other Fraction of Money, Weight, Meaſure, &c. hath its Value found.

The

The Truth of this Rule is manifeſt; for ſuppoſe $\frac{7}{9}$ of a Pound Sterling we know is 17 *s.* 6 *d.* or 7 Half-Crowns; and it will appear to be ſo by the Rule, if work'd as the two Examples above are.

Caſe 6. *To reduce Fractions of different Denominators to thoſe of the ſame Value, which have a common (or one and the ſame) Denominator.*

Example. Reduce $\frac{2}{9}$, $\frac{3}{7}$, and $\frac{4}{5}$ to a common Denominator.

Rule.] Multiply the Denominators one in another for the common Denominator, as 9 times 7 is 63, and 5 times 63 is 315 = the common Denominator.

Then for the 3 new Numerators, multiply every Numerator into all the Denominators except its own, and the Product is a Numerator anſwering to the Fraction whoſe Numerator you multiplied: as the Numerator 2 in 7 and 5 produceth 70, ſo is $\frac{70}{315}$ equal to $\frac{2}{9}$. Then 3 multiplied in 9 and 5 gives 135, ſo is $\frac{135}{315}$ equal to $\frac{3}{7}$. And laſtly, 4 multiplied in 7 and 9 is = 252, ſo is $\frac{252}{315}$ equal to $\frac{4}{5}$. So the 3 new Fractions have each the ſame Denominator, and are in value the ſame as thoſe given. So alſo $\frac{9}{41}$ and $\frac{2}{3}$ are = $\frac{27}{33}$ and $\frac{22}{33}$; $\frac{2}{3}$ and $\frac{3}{7}$ are = $\frac{14}{21}$, and $\frac{9}{21}$, *&c.*

The Truth of this Rule will be evident by reducing any of the Fractions which have the ſame Denominator to its loweſt Term, and that you'll find the primitive Fraction given: as $\frac{70}{315}$ in its loweſt Term is $\frac{2}{9}$ = the Fraction given, and ſo of all the reſt.

This Rule ought to be well minded, it being of principal Uſe in Addition and Subſtraction of Fractions.

Caſe 7. *To reduce Fractions of a ſmaller Denomination to Fractions of a greater.*

Example. What Fraction of a Pound Sterling is $\frac{3}{7}$ of a Farthing?

Rule.] Conſider that $\frac{3}{7}$ of a qr. is $\frac{3}{7}$ of $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{240}$ of a Pound: then reduce this compound Fraction to a ſimple by Caſe 3, and you'll find it $\frac{3}{6720}$ of a Pound. And by the ſame Rule $\frac{15}{19}$ of an Ounce is $\frac{15}{3840}$ of a Pound, *&c.*

The Truth of this appears by the next Caſe.

Caſe 8. *To reduce Fractions of a greater to a ſmaller Denomination.*

Example. What Fraction of a Farthing is $\frac{3}{6720}$ of a Pound Sterling?

Rule.] Multiply the Numerator of the Fraction by ſuch a Number of Units of the leſſer, as make one of the greater Denomination: So here 960 Farthings making 1 *l.* I multiply the Numerator 3 in 960, and place the Product for a Numerator to the Denominator of the Fraction given, which makes the Anſwer $\frac{2880}{6720}$ of a Farthing; which Fraction in its loweſt Terms is $\frac{3}{7}$, and proves the laſt Caſe 7.

to be *right*. And $\frac{1}{3}\frac{5}{0}\frac{}{4}$ lb Averdupois is $\frac{2}{3}\frac{4}{6}\frac{0}{4}$ of an Ounce, which in its loweſt Term is $\frac{1}{1}\frac{5}{9}$, as above. So that theſe two Caſes 7 & 8, prove the Truth of each other.

III. *Addition of Vulgar Fractions.*

Example 1. What is the Sum of $\frac{7}{1}$ and $\frac{3}{8}$?

Rule.] Reduce the Fractions to the ſame Denominator by Caſe 6. of Reduction, (which you'll find $\frac{5}{9}\frac{6}{6}$ and $\frac{3}{9}\frac{6}{6}$.) Then add the Numerators 56 and 36 make 92, which placed over the common Denominator 96 is $\frac{9}{9}\frac{2}{6}$, the Anſwer, or $\frac{2}{2}\frac{3}{4}$.

The Truth of this, &c. is thus proved: Suppoſe the given Fractions be of a Pound Sterling; 7 12ths (or 7 times 20 *d.*) is 11 *s.* 8 *d.* and $\frac{3}{8}$ of a Pound is 7 *s.* 6 *d.* the Sum of which is 19 *s.* 2 *d.* which you'll find to be the Value of the Anſwer $\frac{9}{9}\frac{2}{6}$, by the fifth Caſe of Reduction of Fractions.

Example 2. What is the Sum of $\frac{3}{5}$, and $\frac{7}{8}$ of $\frac{2}{7}$ of $\frac{5}{9}$?

Rule.] Firſt reduce the compound Fraction $\frac{7}{8}$ of $\frac{2}{7}$ or $\frac{1}{4}$ of $\frac{5}{9}$ to a ſingle Fraction, which you'll find $\frac{7}{5}\frac{0}{4}$ or $\frac{5}{3}\frac{}{6}$; to which add the $\frac{3}{5}$, as *per* Example 1. and you'll find the Sum $\frac{1}{2}\frac{8}{5}\frac{6}{2}\frac{2}{6}$, or $\frac{3}{3}\frac{}{6}$, (the Anſwer by Caſe 3. of Reduction.)

Example 3. What is the Sum of $17\frac{3}{4}$ and $\frac{2}{3}$ of $\frac{3}{4}$?

Rule.] The compound Fraction in a ſimple is $\frac{6}{1}\frac{}{2}$, which added to the Fraction-part of the mixt Number, maketh $\frac{6}{4}\frac{}{8}$, which by the ſecond Caſe of Reduction is $1\frac{1}{4}\frac{2}{8}$ or $1\frac{1}{4}$; which added to 17, gives the Sum $18\frac{1}{4}$. *The Truth of which is proved* by ſuppoſing $17\frac{3}{4}$ to be 17 *s.* 9 *d.* and $\frac{2}{3}$ of $\frac{3}{4}$ to be ſo of a Shilling, which is 6 *d.* the Sum of of which is 18 *s.* 3 *d.* or $18\frac{1}{4}$, as above.

IV. *Subſtraction of Vulgar Fractions.*

Example 1. From $\frac{9}{9}\frac{2}{6}$ take $\frac{3}{8}$.

Rule.] The Fractions in a common Denominator are $\frac{7}{7}\frac{3}{6}\frac{6}{8}$ (equal to $\frac{9}{9}\frac{2}{6}$) and $\frac{2}{7}\frac{8}{6}\frac{8}{8}$ (equal to $\frac{3}{8}$) therefore 288 deducted from 736, the other Numerator, the Remainer is 448; ſo the Anſwer is $\frac{4}{7}\frac{4}{6}\frac{8}{8}$; (which in its loweſt Term is $\frac{7}{1}\frac{}{2}$, and *proves* the firſt Example in Addition of Vulgar Fractions.) And this Remainer (as in Whole Numbers) add to the Subtrahend $\frac{3}{8}$, gives the Sum $\frac{9}{9}\frac{2}{6}$, *which proves* (*that way alſo*) this and the firſt in Addition of Vulgar Fractions *to be truly performed.*

Example 2. From $\frac{1}{2}\frac{8}{5}\frac{6}{2}\frac{2}{6}$ take $\frac{7}{8}$ of $\frac{2}{7}$ of $\frac{5}{9}$.

Rule.

Rule.] 1*ſt*, Reduce the compound Fractions to a ſingle, which you'll find by the third Caſe in Reduction to be $\frac{7}{5}\frac{0}{4}$.

2*dly*, Reduce $\frac{1}{2}\frac{8}{5}\frac{6}{2}\frac{2}{0}$ and $\frac{7}{5}\frac{0}{2}$ to one and the ſame Denominator by the ſixth Caſe of Reduction, which are $\frac{9}{1}\frac{3}{3}\frac{8}{7}\frac{4}{0}\frac{4}{8}\frac{8}{0}$ (equal to $\frac{1}{2}\frac{8}{5}\frac{6}{2}\frac{2}{0}$) and $\frac{1}{1}\frac{7}{2}\frac{6}{7}\frac{4}{0}\frac{0}{8}\frac{0}{0}$ (equal to $\frac{7}{5}\frac{0}{4}$.)

3*dly*, Deduct the Numerator 176400 from the other Numerator 938448, and the Remainer is 762048: ſo the Anſwer is $\frac{7}{1}\frac{6}{2}\frac{2}{7}\frac{0}{0}\frac{4}{8}\frac{8}{0}$. And that in its loweſt Terms (by the fourth Caſe of Reduction) you ſhall find $\frac{3}{5}$, by dividing each part of the Fraction by the common Meaſurer or Diviſor 254016. *And this proves not only the Truth of the ſecond Example in Addition, but alſo that this Example is rightly performed.*

Example 3. From $18\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$.

Rule.] 1*ſt*, Reduce $\frac{2}{3}$ of $\frac{3}{4}$ to 1 Fraction as before, which is $\frac{6}{1}\frac{}{2}$.

2*dly*, Reduce $\frac{6}{1}\frac{}{2}$ and $\frac{1}{4}$ (the Fraction-part of the mixt Number given) to a common Denominator, which are $\frac{3}{4}\frac{2}{8}$ (equal to $\frac{1}{4}$) and $\frac{2}{4}\frac{4}{8}$ (equal to $\frac{6}{1}\frac{}{2}$.)

3*dly*, Now you ſhould take $\frac{2}{4}\frac{4}{8}$ from $\frac{1}{3}\frac{2}{4}\frac{}{8}$, but you cannot, as being leſs; therefore borrow 1 or $\frac{4}{4}\frac{8}{8}$ from the 18, will leave 17. Then add $\frac{4}{4}\frac{8}{8}$ to the $\frac{1}{4}\frac{2}{8}$, makes $\frac{6}{4}\frac{0}{8}$, from which take the $\frac{2}{4}\frac{4}{8}$, and there remains $\frac{3}{4}\frac{6}{8}$, which in its loweſt Term is $\frac{3}{4}$; ſo the Remainer or Anſwer is $17\frac{3}{4}$, and *proves* the third Example in Addition. But this is done ſhorter by omitting the Numerators and Denominators which are the ſame Digits as $\frac{2}{3}$ of $\frac{3}{4}$ is $\frac{2}{4}$ or $\frac{1}{2}$, *&c.* as under Caſe 3. of Reduction.

Which 3 Examples in Subſtraction, and thoſe 3 in Addition, do mutually prove each other.

And thus I have given as many Examples as are neceſſary, in order to the perfect underſtanding of Addition and Subſtraction, which will prove very eaſy, (as they are ſo plainly expreſſed) eſpecially to ſuch as have a due knowledge of Reduction of Vulgar Fractions. I ſhall therefore proceed to

V. *Multiplication of Vulgar Fractions.*

Example 1. Multiply $\frac{7}{1}\frac{}{5}$ by $\frac{9}{1}\frac{}{0}$.

Rule.] Multiply the Numerators together for a new Numerator, as here 7 by 9 is 63; and the Denominators together for a new Denominator, as 15 by 10 is 150: ſo that $\frac{6}{1}\frac{3}{5}\frac{}{0}$ is the Anſwer.

Example 2. Multiply $\frac{5}{7}$ of $\frac{2}{3}$ by $\frac{7}{8}$ of $\frac{8}{9}$.

Rule.]

Rule.] Work as before; for the Product of 5 in 2 in 7 and in 8, is 560 the Numerator; and 7, 3, 8, and 9 together, gives 1512: so is $\frac{560}{1512}$ the Answer, or $\frac{10}{27}$ in its lowest Terms.

Example 3. Multiply 25 by $\frac{7}{12}$.

Rule.] The whole Number wrote Fraction-ways is $\frac{25}{1}$, which multiply as by the Rule 1. and the Product is 175, (of the Numerators) and that of the Denominators is 12: so the Answer is $\frac{175}{12}$, or by the second Case of Reduction $14\frac{7}{12}$.

Thus you see in Multiplication of Fractions the Product is less than one of the Factors; and 'tis so much less, as the Numerator of the Multiplyer is less than the Denominator, (in this Example) or so much as 7 is less than 12 its Denominator: for if the Numerator 7 were 12, it's plain that $\frac{12}{12}$ (as is said before) is 1, and 1 time 25 would be 25, which would make the Product equal to the Multiplicand; and therefore as 7 is less than 12, so must the Product $14\frac{7}{12}$ be less than 25.

Example 4. Multiply $34\frac{7}{8}$ by $13\frac{11}{12}$.

Rule.] Reduce both the mixt Numbers to improper Fractions, and then proceed as by the first Rule in Multiplication of Fractions.

Thus $34\frac{7}{8}$ is $\frac{279}{8}$, and $13\frac{11}{12}$ is $\frac{167}{12}$, and the Product of the Numerators 279 and 167 is 46593, and of the Denominators (96) so the Answer is $\frac{46593}{96}$, or $485\frac{33}{96}$.

VI. *Division of Vulgar Fractions.*

Example 1. Divide $\frac{63}{1575}$ by $\frac{7}{15}$.

Rule.] Place the Fractions as in the Margin; then multiply the Numerator of the Divisor by the Denominator of the Dividend, and the Product is 1050, the Denominator of the Quotient. And the Denominator of the Divisor in the Numerator of the Dividend produceth 945, the Numerator of the Quotient; which is therefore $\frac{945}{1050}$, in its least Terms $\frac{9}{10}$: *And proves the Truth* of the first Example in *Multiplication* of Vulgar Fractions.

$\frac{7}{15}) \frac{63}{1575} (\frac{945}{1050}$

Example 2. Divide $14\frac{7}{12}$ by 25.

Rule.] Reduce the mixt Number to an improper Fraction, and put a Unit under the 25, then work as *per* the last Rule, and as in the Margin. Where you see the Quotient is $\frac{175}{300}$, or in its least Terms is $\frac{7}{12}$. *And this proves the Truth* of Example 3. in Multiplication, as *that proves this true.*

Divisor.	Dividend.	Quote.
$\frac{25}{1}$)	$14\frac{7}{12}$ or $\frac{175}{12}$	($\frac{175}{300}$ or $\frac{7}{12}$

Exam-

Example 3. Divide $485\frac{3}{9}\frac{3}{6}$ by $13\frac{1}{1}\frac{1}{2}$.

Rule.] Reduce the mixt Numbers to Fractions, and you'll have $4\frac{6}{9}\frac{5}{6}\frac{9}{}$ equal to $485\frac{3}{9}\frac{3}{6}$ = the Dividend, $\frac{1}{1}\frac{6}{2}\frac{7}{}$ = $13\frac{1}{1}\frac{1}{2}$ = the Divisor, and $\frac{5}{1}\frac{5}{6}\frac{9}{0}\frac{2}{3}\frac{1}{2}\frac{6}{}$ = the Quotient; which being reduced to a mixt Number, is $34\frac{1}{1}\frac{4}{6}\frac{0}{0}\frac{2}{3}\frac{8}{2}$, or $34\frac{7}{8}$, the Fraction being in its lowest Terms, (dividing each part by the common Measurer 2004.)

$\frac{1}{1}\frac{6}{2}\frac{7}{}$ ($4\frac{6}{9}\frac{5}{6}\frac{9}{}$ ($\frac{5}{1}\frac{5}{6}\frac{9}{0}\frac{2}{3}\frac{1}{2}\frac{6}{}$ or $34\frac{7}{8}$ = the Answer.

And this manifestly proves the Truth of the 4th Example in Multiplication of Fractions.

I have in the *Merchant's Magazine* shewn the Reason of all the Rules above mentioned, for Reducing, Adding, &c. Vulgar Fractions; and have not room to repeat that here: but have fully shew'd how one Rule proves the Truth of another, which is a good Demonstration of the Genuineness of all.

VII. *To Extract the Roots of Vulgar Fractions.*

Rule 1.] You must always reduce your Fraction into its least Terms: for if the Root can be justly extracted in any Terms, it can be so in its lowest. Tho when you can see, as sometimes it happens, that the Roots may be immediately extracted of the Fraction in the Terms given, then you need not reduce it to its lowest. Thus for

Example, The Square Root of the Fraction $\frac{1}{1}\frac{0}{4}\frac{0}{4}$ is = $\frac{1}{1}\frac{0}{2}$, the Answer = $\frac{5}{6}$. And if the $\frac{1}{1}\frac{0}{4}\frac{0}{4}$ had been reduced to its least Terms, they would have been = $\frac{2}{3}\frac{5}{6}$, whose Square Roots are $\frac{5}{6}$, as before.

Example 2. When the Square Root of a mixt Number is required, as suppose of $56\frac{1}{4}$; reduce the mixt Number to a Fraction, and extract the Root of both Terms as before: so $56\frac{1}{4}$ is = $\frac{2}{4}\frac{2}{}\frac{5}{}$, whose Square Root is $\frac{1}{2}\frac{5}{}$ = $7\frac{1}{2}$ the Answer, (for the $\frac{2}{4}\frac{2}{}\frac{5}{}$ is given in its least Terms) and if you multiply $7\frac{1}{2}$ by $7\frac{1}{2}$, the Product is $56\frac{1}{4}$ *for Proof.* But

Note, That when a Fraction is given, whose Root cannot be extracted without Remainer, you must reduce it to a Decimal, and proceed to get the Root thereof, as *per* the Rules and Examples at the End of Decimals; or it may in most Cases be done near enough by Logarithms, as at the end of *Sect.* 3. of *Chap.* 6.

II. *To extract the Cube Root of Vulgar Fractions.* Reduce the Fraction to its least Terms, and then extract the Cube Root of each for those of the Root, unless you can see that the Roots may be imme-

immediately extracted of the Terms given. For example, to get the Cube Root of $\frac{7\,2\,2}{3\,3\,7\,5}$, this Fraction in its leaſt Terms is $\frac{2\,7}{1\,2\,5}$, whoſe Cube Root is $\frac{3}{5}$. Or if you had done it without reducing to its loweſt Terms, the Roots of the Terms given would be 9 and 15, or $\frac{9}{1\,5}$, which is equal to $\frac{3}{5}$, as before.

For the Root of a mixt Number, reduce it to an improper Fraction, and proceed as by the laſt Example. But when the Root cannot be aocurately enough extracted without trouble, you may proceed by Decimals or Logarithms, as is ſaid above.

Note, That the Uſe of the Square and Cube Roots you have partly in the two next Sections.

VIII. *The Application or Uſe of Vulgar Fractions.*

Queſt. 1. Two Bags contain $470\frac{7}{8}$ Dollars, but the greater exceeds the leſſer $32\frac{9}{1\,3}$ Dollars: how much is in each Bag?

Rule.] Subtract the Difference from the Sum, and there reſts $438\frac{1}{1\,\cdot\,4}\frac{9}{}$ Dollars; half of which is $219\frac{1}{2}\frac{9}{0\,2}$, the Content of the leſſer Bag; to which add the Difference $32\frac{9}{1\,3}$, and the Sum is $251\frac{1}{2}\frac{6\,3}{0\,8}$ Dollars in the greater Bag: *The Sum of which for Proof* is $470\frac{7}{8}$.

Queſt. 2. A Brick-Wall contains $1792\frac{1\,3}{7\,1}$ ſquare Feet on the Superficies, how many Rod is that of $272\frac{1}{4}$ Feet to the Rod?

Rule.] Divide $1792\frac{1\,3}{7\,1}$ by $272\frac{1}{4}$, and the Quotient is $\frac{5\,0\,8\,9\,8\,\cdot}{7\,7\,3\,1\,9}$, or $6\frac{4\,5\,0\,6\,6}{7\,7\,3\,1\,9}$ Rod for Anſwer.

Queſt. 3. In $846\frac{3}{8}$ Pole how many Yards of $5\frac{1}{2}$ Yards to the Pole?

Rule.] Multiply the one by the other gives the Anſwer $4655\frac{1}{1\,6}$ Yards.

Queſt. 4. What is the Value of 87 *C.* — *q.* 13 ℔. at 1 *l.* 9 *s. per C*?

Rule.] The Weight is $87\frac{1\,3}{1\,1\,2}$ *C.* or $\frac{9\,7\,5\,7}{1\,1\,2}$ *C.* the Money is $\frac{2\,9}{2\,0}$ *l.* multiply the Fractions together gives $\frac{2\,8\,2\,9\,5}{2\,4\,0}$ *l.* which by the fifth Caſe of Reduction of Fractions is = 126 *l.* 6 *s.* 4 *d.* 1 *q.* $\frac{4}{7}$.

Queſt. 5. If I give *l.* 126 : 6 : 4 : 1 $\frac{4}{7}$ for 87 *C.* 0 *q.* 13 ℔. of Sugar, what is that *per* Hundred weight of 112 *per C*?

Rule.] Divide the Money (as $126\frac{2}{6}\frac{1}{7}\frac{3}{2}\frac{9}{0}$) by the Weight $87\frac{1\,3}{1\,1\,2}$ *C.* and the Quotient is exactly *l.* 1 : 9 : —, the Anſwer.

And this proves the Truth of the laſt Queſtion.

Queſt. 6. What is the Product of 5 *s.* 7 *d.* by 7 *s.* 5 *d*?

Rule.] Multiply $5\frac{7}{1\,2}$ *s.* by $7\frac{5}{1\,2}$ *s.* (the Pence being ſo many 12ths of a Shilling) and the Product is $41\frac{5\,9}{1\,4\,4}$ Shillings, or *l.* 2 : 1 : 4 : $3\frac{2}{3}$.

Queſt. 7. Divide *l.* 2 : 1 : 4 : $3\frac{2}{3}$ by $7\frac{5}{1\,2}$ Shillings, (or 7 *s.* 5 *d.*) The firſt, in a mixt Number is $41\frac{5\,9}{1\,4\,4}$ *s.* which divided by $\frac{8\,9}{1\,2}$, ($41\frac{5\,9}{1\,4\,4}$ being

being firſt reduced to an improper Fraction) the Quotient is $\frac{7}{1}\frac{1}{2}\frac{5}{0}\frac{5}{6}$ or $5\frac{7}{12}$ *s.* *This proves the laſt Queſtion* to be truly wrought.

Queſt. 8. What is the Product of *l.* 5 : 7 : 10 $\frac{1}{4}$ multiplied in itſelf?

Rule.] Reduce the 7 *s.* 10 *d.* $\frac{1}{4}$ into Farthings, and thoſe Farthings into the Fraction of a Pound by the ſeventh Caſe of Reduction of Fractions: then you have *l.* $5\frac{3}{9}\frac{7}{6}\frac{7}{0}$ to ſquare, (or multiply by itſelf) which produceth *l.* 29 : 1 : 7 : 2 $\frac{4}{9}\frac{7}{3}\frac{4}{6}\frac{4}{0}$, the Anſwer.

I ſhould not have inſerted this and the ſixth Queſtion above, but that there is much noiſe (tho little real Uſe) of them; ſome Perſons being deceived by thinking to anſwer them (for example) by reducing in the 6th Queſtion the 5 *s.* 7 *d.* into Pence, and multiplying them by the Pence in 7 *s.* 5 *d.* and then reducing the Pence of the Product into Shillings or Pounds by dividing by 12, *&c.* But this way gives 12 times the Anſwer, becauſe, as appears, the Pence ſhould be divided by 144, or 12 times 12 = the Product of the Denominators of the Fraction. And ſo in the laſt Example they will divide the Farthings in the Product of thoſe in the Number given multiplied in itſelf by 960; whereas it ought to be divided by the Square of that, *viz.* 921600.

On the contrary, others think to perform the Work of the ſixth Queſtion by reducing the 67 and 89 Pence to the Fraction of a Pound, multiplying $\frac{6}{2}\frac{7}{4}\frac{7}{0}$ by $\frac{8}{2}\frac{9}{4}\frac{9}{0}$. But here 'tis plain the Anſwer will be ſo much too little, as $\frac{5}{5}\frac{5}{7}\frac{9}{8}\frac{6}{0}\frac{3}{0}$ *l.* is leſs than $\frac{5}{2}\frac{9}{8}\frac{6}{1}\frac{3}{0}$ *l.* *i.e.* it will be but $\frac{1}{2}\frac{}{0}$ of the true Anſwer.

Hence it appears, that ſuch Queſtions are only naturally and accurately reſolved by Fractions, as in the ſaid Examples; for which reaſon I have given thoſe two above in this part of the Uſe of Fractions, but hope the ingenious Reader will excuſe this Digreſſion on ſo trivial an Inſtance.

Sect. II. *Progreſſion.*

THIS Part of Arithmetic, tho neglected both by many Authors of Arithmetical Tracts, and Teachers of the Science, is however of excellent Uſe, as ſhewing in a great Variety of Inſtances the wonderful Power and Harmony of Numbers, and their Relation one to another.

This Relation of Numbers is either Arithmetrical or Geometrical.

I. *Arithmetical Progreſſion*, or Relation of Numbers, is when a Series thereof differ by the Addition of ſome Number to the firſt, ſecond, &c. So theſe Numbers

1	2	3	4	5	6	7	8	9	10	11	12, &c.
2	4	6	8	10	12	14	16	18	20	22	24, &c.
3	6	9	12	15	18	21	24	27	30	33	36, &c.

Each of thoſe in the firſt Series or Row differ by 1, each of thoſe in the ſecond Series by 2, and in the third by the common Addition of 3. And a Series of abundant Numbers are 30, 42, 54, 66, &c. which differ by 12. Now,

1. *To find the Sum of any of the Series's*, you muſt multiply half the Sum of the firſt and laſt Terms by the Number of Terms; or half the Number of Terms by the Sum of the firſt and laſt, and the Product gives the Sum required.

Thus 1 and 12 is 13 by 6 (half the Terms) gives 78 the Sum.
2 and 24 is 26 by 6, gives 156 = the Sum of the 2d Series.
3 and 36 is 39 by 6, gives 234 = the Sum of the 3d Series.

And the like is to be obſerved in ſumming up any other Rows of Numbers, tho never ſo large, or however differing, if Arithmetically continued.

2. It may be obſerved, that the ſeveral Sums of the three Lines above, or any other of equal Numbers of Terms, beginning with ſucceſſive Digits continued, do differ alſo in Arithmetical Proportion; the common Difference being the Sum of the firſt Series, as 78, 156, 234, &c.

Queſt. 1. How many Strokes does the Hammer of a Clock ſtrike in the 12 Hours? This is done as the firſt Example above, the Anſwer being 78, and would have been the ſame had you multiplied half the firſt and laſt, *viz.* $6\frac{1}{2}$ by 12, the whole Number of Terms.

Queſt. 2. Admit a Boy is to collect 100 Apples, which lie a Yard diſtant from each other, and to put each of them ſingly into a Basket placed one Yard from the firſt; how many Yards does he paſs?

Here the firſt Term is 2 Yards, the laſt 200, (to the laſt Apple, and back to the Basket) Sum 202, which multiplyed by 50, (half the Number of Terms) produceth the Sum of the Yards paſſed by the Boy, which is 10100, or upwards of five Miles.

Queſt.

Queſt. 3. How many Feet does an heavy Body fall in 11 Seconds of Time, ſuppoſing it to fall 16 Foot the firſt Second, 3 times that the next Second, 5 times that the 3d Second, *&c.* as in the Example, (or by continually adding 32 to the firſt Term) the 11th Term is 336 Feet, which the Body falls in the 11th Second, (ſo prodigious is the Increaſe of the Velocity:) and if $\frac{1}{2}$ the laſt and firſt together be multiplied by the 11, the Sum of all the Feet that it falls is 1936.

The Seconds a Body falls.	*Multiplyers.*	*Feet an heavy Body falls in each Second.*
1	1	16
2	3	48
3	5	80
4	7	112
5	9	144
6	11	176
7	13	208
8	15	240
9	17	272
10	19	304
11	21	336

Thus if you would take the Depth of a Well, or the like, ſuppoſe by a Watch that vibrates Quarter Seconds, I find a Stone 44 Quarters or 11 Seconds in falling as above, the Depth of ſuch a Well, *&c.* is found 1936 Feet.

And in this Progreſſion 'tis plain that any of the Terms are found without the intermediate, by multiplying 16 by double the number of Seconds leſs 1. Thus I find that it falls in the 8th Second, 240 Feet, by multiplying 16 by 15.

3. *To find a mean Arithmetical Proportional* between any *two Numbers.* Take *half the Sum of the* 2 *Numbers* or Extremes for Anſwer, as in the Examples above; or *add half the Difference to the leſſer.*

A Mean between 9 and 11 in the firſt Line is 10.
20 and 24 in the 2d Series is 22.
27 and 33 in the 3d . . . . . 30, *&c.*

4. *The common Difference and Number of Terms given to find the laſt Term.* Thus in the 2d Series the Number of Terms (12) being multiplied by the common Difference 2, gives 24, the laſt Term, *&c.* or in any Series multiply the Number of Terms leſs 1 by the common Difference, and add the firſt Term.

5. *Any* 2 *Numbers ſtanding together given to find a third,* &c. Take their Difference, and add to the greater, gives the 3d, *&c.* Or ſubſtracted from the leſſer, gives the leſſer Terms, as in the third Series 21 and 24 are given to find the 3d Term; the Difference is 3, which added to 24 gives 27, the next Term higher; or ſubſtracted from 21 gives 18, the next Term lower.

6. *If any four Numbers are in Arithmetical Proportion*, whether *continued* or *interrupted*, the Sum of the two middle Numbers are equal to the Sum of the two Extremes. Thus

In the firſt Line 7, 8, 9, 10; 7 and 10 are equal to 8 and 9:

Alſo in 7, 8, 14, 15; 7 and 15 are equal to 14 and 8.

And in the 3d Line 12, 15, 18, 21; 12 and 21 are equal to 15 and 18.

7. *If three Numbers are in Arithmetical Proportion continued*, the Double of the Mean is equal to the Sum of the two Extremes, as 12, 15, 18; 2 times 15 is equal to 18 and 12.

8. *If three Numbers are given, a fourth may be found*, by adding together the 2d and 3d, and from that Sum ſubſtracting the firſt, as in 14, 15, 16, the Sum of 15 and 16 is 31, from which take 14, and the Remainer is 17, the 4th in Arithmetical Proportion; and this alſo holds, tho the Progreſſion be interrupted, as 14, 15, 25, 26.

9. *The Total of the Progreſſion, and the firſt and laſt Terms given, to find the Number of Places*; divide the Total by half the Sum of the firſt and laſt Terms, and the Quotient is the Number of Terms or Places.

10. *The laſt Number and common Difference given, to find the Number of Terms*; divide the laſt Number by the Exceſs or common Difference.

11. *The Sum of the Progreſſion, and the firſt and laſt Terms given, to find the common Difference.* Divide the Total of the Progreſſion by half the Sum of the firſt and laſt Terms, and the Quotient is the Number of Terms. Then from the laſt Term take the firſt, and the Remainer divide by the Number of Terms leſs 1, and the Quotient is the Exceſs or Difference ſought, as will appear by any of the three Series's above.

The Reaſon of the Rule for ſumming up an Arithmetical Progreſſion. According to the 3d Propoſition laſt above, half the Sum of the two Extremes is an Aritinmetical Mean; and a Mean between the firſt and laſt Terms of a Progreſſion, according to the ſame Rule, is found by the firſt Propoſition: and ſince that is a Mean between the extreme Terms, therefore that being multiplied by the Number of Terms, muſt neceſſarily give the Total of them all.

Or more plainly: Take any odd Number of Terms in the three Series's above, and you'll find that Term ſtanding in the middle to be the Mean, according to the ſaid 3d Prop. Thus in the ſeven firſt Terms in the ſecond Series, the Mean (or middle Number) is 8, there being three on each ſide; ſo that one with another, each

Term

Term is 8, as you'll find it: for 6 (the next towards the left hand) is 2 lefs than 8, but then 10 (the next towards the right hand) is 2 more than 8; and 4 (the 2d towards the left hand from the 8) is 4 lefs than 8, but then 12 (the 2d toward the right hand from 8) is 4 more than 8: fo laftly, 2 (the 3d toward the left hand from the 8) is 6 lefs than 8; but then 14 (the 3d toward the right hand) is 6 more than 8. So that nothing is more plain, than that each Term (one with another) being 8, that multiplied by the Number of Terms muft give the Sum of all the Terms (or Eights:) fo the Sum of 7 of the Numbers of the 2d Series aforefaid is 56 (or 7 times 8.) And fo of any other Series, grounded on the firft Prop. above.

Geometrical Progreffion.

This is when a Series of Numbers are increafed by a continual Multiplication of the firft Term, and the Products arifing, by fome certain Number, called the Ratio or common Factor: as

1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024.
3, 9, 27, 81, 243, 729, 2187, 6561, 19683, *&c.*
4, 16, 64, 256, 1024, 4096, 16384, 65536, *&c.*

Prop. 1. To fum up any Series of Numbers, whofe Relation is in a Geometrical Progreffion.

The firft Way to find the Total of a Geometrical Progreffion.

Rule.] Multiply the laft Number by the common Multiplyer.
2*dly*, From that Product deduct the firft Number.
3*dly*, Divide the Remainer by the faid Multiplyer lefs one; and the Quotient is the Sum fought.

The Example fhall be in the finding the Aggregate of the middle Series above, the laft Number whereof is 19683; which multiplied by the common Multiplyer is 59049, from which take the firft Term of the Progreffion (3) refts 59046, which divide by the faid Multiplyer lefs (1) *viz.* by 2, and the Quotient is 29523 = the Sum required.

The fecond and much briefer Way to find the Total of a Geometrical Progreffion, without many of the intermediate Terms, or the laft Term being given.

Confider that in the Series of the laft Example or middle Series there are 9 Terms; therefore if you multiply the 5th (or 243) by itfelf,

ſelf, it will at once produce the 59049 as before, (which would be the 10th Term, if the Progreſſion had run ſo far) whence the Sum is found as above. For,

Note 1. That when the Number of Terms are odd, and the firſt is above a Unit, the Square of the middle Term gives that next above the laſt Term, as in the laſt Example.

Note 2. If the Number of Terms be odd, and the firſt Term be but a Unit, then the Square of the middle Term gives the laſt Term of the Progreſſion, as in the firſt Series the Square of 32 is the laſt Term = 1024.

Note 3. If the Terms be an even Number, and the firſt Term be One or Unity; then the Square of the Sum in the place of half the Number of Terms gives the laſt Term ſave one: as in the 10 firſt Terms of the firſt Series, the Square of the fifth Term (16) gives 256 = the laſt of the 10 Terms but one.

Note 4. If the Number of Terms be even, and the firſt Term be more than a Unit, then the Square of the Sum in the place of half the Number of Terms, gives the laſt Term of the Progreſſion, as in the third Series the Square of 256 is the laſt Term 65536.

Theſe Rules are more particular and uſeful in the ſumming up all kinds of Geometrical Progreſſions than I have any where obſerved to be exhibited, and therefore worth noting, for they always hold, as in the two Series's above; and where the Nature of the Progreſſion is as in the firſt Rank or Line; as is thus farther demonſtrated:

0,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10
1,	2,	4,	8,	16,	32,	64,	128,	256,	512,	1024

The upper Series being Arithmetical, the Addition of any two, or Double of any one, ſhews reſpectively what is produced by multiplying or ſquaring thoſe under them in the lower Line. Thus 4 doubled gives 8 in the upper Line, under which ſtands 256, or the Square of the Number under the 4, *&c.* So any 2 added in the upper Line, as 3 and 6, give 9: which ſtands over the Product of the 2 Numbers 64 and 8, which is 512.

The Reaſon of the Rule for ſumming up a Geometrical Progreſſion.

It will be the more eaſily underſtood by a Series of a few Terms. Thus if I would know the Sum of 4 and 8, it is 4 (or the firſt Term) leſs than the laſt Term 8 multiplied by the common Factor

(2) which plainly ſhews why you deduct the firſt Term (here 4.) So alſo in 2, 4, 8, the Double of 8 is 2 (or the firſt Term) more than the Sum 14, and therefore from the 16 muſt be deducted the firſt Term (2.) Laſtly, in 1, 2, 4, 8, twice 8 (the laſt Term) is 16, which is the firſt Term (1) more than the Sum (15). And this is ſufficient to ſhew the Reaſon why we multiply the laſt Term by the common Factor, and why from the Product the firſt Term is deducted.

Now, as when the Ratio or common Factor is (2) the Sum of the Progreſſion is $\frac{2}{1}$ the laſt Number after the firſt is deducted from the Product; ſo when the common Factor is 3, the Anſwer is $\frac{3}{2}$; if the common Factor be 4, the Anſwer is $\frac{4}{3}$ of the laſt Number (or Term) having before Diviſion the firſt Term deducted from the Product. Thus in 3 and 9, the Sum is 4 three's, or 12, which is thrice the laſt Term (9) leſs the firſt Term (3) divided by 2. So alſo in 4 and 16, the Sum is 4 times 16, leſs the firſt Term (4) dividing the Remainer by 3; as might eaſily (from ſo few Terms) at firſt be diſcover'd. But ſee more at the end of this Section.

Queſt. 1. A King of much Virtue and Valour, admirably eſteem'd by his Subjects, returning from the Wars with Victory and Peace, very much Emulation appear'd who ſhould exceed in Demonſtrations of Joy. Among the reſt, the Governour of the Fortreſs intending to ſignalize himſelf, orders his Sub-Officers to make ſo many Diſcharges of Cannon; *viz.* 3 for the firſt Year of the King's Age, (which was 25 Years) 9 for the ſecond Year, 27 for the third Year, *&c.* (not conſidering the Impoſſibility of the Performance) the Queſtion is, how many Diſcharges were to be made, and how much Powder conſumed, ſuppoſing the Guns to be each a Culverin, whoſe Requiſite of Powder is lb 10?

The

The 13th Term 1594323 } Mult.
Ditto . . . 1594323 }

4782969
3188646
4782969
6377292
14348907
7971615
1594323

This is the 26th Term (or the next above the laſt) *per* Note 1. foregoing. } 2541865828329

The firſt Deduct. 3

Reſts = 2541865828326

Half of which is = 127093291416 3, the Sum of the Progreſſion, or the Number of Diſcharges order'd.

Which, at 10 Pound of Powder at each Diſcharge, gives 1270932914163 0 lb. at 100 lb. each Barrel, is 12709329141630 lb. at 100 lb. each Barrel, is 127093291416 $\frac{3}{10}$ Barrels; which would lade 14184965 Ships, at 400 Ton each Ship.

Years.	Diſchar.
1ſt	3
2d	9
3d	27
4th	81
5th	243
6th	729
	729
	6561
	1458
	5103
12th Term by Note 4.	531441
	3
13th Term ...	1594323

Queſt. 2. On the ſame Occaſion all the Bells in the King's Metropolis were directed to ring as many Changes as they were capable of. Now there being 10 Churches, 1 of which had 2 Bells, another 3, *&c.* the laſt 10 Bells; how many Changes could be rung on all the Bells at each Church, and what the Sum Total of all that Progreſſion?

Churches.	*Bells.*	*Changes to be rang at each.*
St. *Peter's*	2	2
St. *Andrew's*	3	6
St. *James's*	4	24
St. *John's*	5	120
St. *Bartholomew.*	6	720
St. *Thomas's*	7	5040
St. *Matthew's*	8	40320
St. *Simon's*	9	362880
St. *Jude's*	10	3628800

The Number of Bells multiplied (any way) one in another, gives the laſt Term, or Changes that can be rung thereon. Then for the Sum, multiply the laſt Term by the correſpondent Number of Bells, and divide the Product

duct by the Number of Terms, and the Quote is *the Answer for four Bells*: For 5 Bells add 2 to the Rule, for 6 add 8, for 7 add 32, for 8 Bells add 152, for 9 add 872, and for 10 add 5912, gives the Sum of the Progressions, here 4037912.

Note, The 2 is the first Term, the 8 the Sum of the 2 first, the 32 = the 3 first, the 152 = the 4 first, the 872 = the 5 first, and the 5912 = the Sum of the 6 first Terms.

Quest. 3. Any Line or Number given, to divide the same into extreme and mean Proportionals. To the Square of the whole Line or Number given, add $\frac{1}{4}$ of that Square; extract the Square Root of the Sum, from which Root deduct half the Line or Number given, and the Remainer is the greater part. And for a Proof, the Rectangle or Product of the whole Line by the lesser part, is equal to the Square of the greater part, by *Euclid* 11. 2.

4thly, If three Numbers be given in Geometrical Proportion continued, the Product of the two Extremes is equal to the Square of the Mean, as 5, 20, 80, equal to 400.

5thly, If two Numbers be given, it follows from the last, that a mean Proportional may be found by multiplying them together, and extracting the Square Root of the Product. Thus in the last Example 5 times 80 is 400; the Square Root of which is 20 = the Mean sought.

6thly, If you would find two Geometrical mean Proportionals between two Numbers given, as suppose between 5 and 320, you must divide the greater by the less; then extract the Cube Root of the Quotient; lastly, by that Root multiply the first Term, gives the first Mean, which multiply by the said Root gives the second, so is 5, 20, 80, 320, the Numbers in order, 20 and 80 being the Means required.

7thly, Or three mean Proportionals may be found thus: Suppose between 5 and 1280. Divide the greater Extreme by the lesser, extract the Biquadrate Root of the Quotient, and by that Root multiply the lesser Extreme continually 3 times; so will the Answer be found 5. 20. 80. 320. 1280.

8thly, If four Numbers be given in Geometrical Proportion, the Product of the two Extremes is equal to that of the two Means: so in the last Example 5 times 320 is equal to 20 times 80, *viz.* 1600.

9thly, If two Numbers be given, a third in Geometrical Proportion may be found by dividing the greater by the lesser, and multiplying such greater by the Quotient. As *per* the 5th, 80 is found

in proportion as 5 to 20; for as 5 to 20, ſo is 20 to 80, as may be proved by the 3d or 6th Caſes above.

10*thly*, Three Numbers given in Geometrical Proportion, a fourth may be found by multiplying the ſecond and third together, and dividing the Product by the firſt: as in the 5th 20 times 80 is 1600, which divided by 5, gives the 4th Proportional 320. This laſt is the Foundation of the Rule of Three Direct, which is the next thing to be taught after I have ſhewed

The Proceſs for finding out the Canon whereby to diſcover the Sum of a Geometrical Progreſſion.

But firſt note that

:: { ſhews a *Geometrical Proportion.*
— ſignifies *leſs.*
= ſignifies *equal to.*
× ſignifies *multiplied in.*

And in the Literal Work,

f *the firſt Numb. of the Progreſſion.*
r *the Ratio or common Factor.*
u { *the Sum of the Progreſſion,* which is unknown.
l *the laſt Term of the Progreſſion.*

The Sum of the Progreſſion to be found is this Example,

1, 2, 4, 8, 16, 32.

Literally performed.	Numerally performed.
f. fr :: u—l. u—f	that is 1. 2×1 :: u—32. u—1
fu—ff=rfu—rfl.	that is u—1×1=2×1×u—32×2×1
u—f=ru—rl	that is u—1=2×u—2×32
ru—u=rl—f	that is 2u—u=2×32—1
$u = \frac{rl-f}{r-1}$	that is $u = \frac{2\times32-1}{2-1}$ = the Anſw.

So that 'tis plain the Anſwer is (2) the Ratio multiplyed in (32) the laſt Term, made leſs by (1) the firſt Term, and that Remainer divided by (2) the Ratio, leſs 1, the Quotient is (63) the Sum of the Progreſſion (or u): And this Canon (or Rule) holds in all Geometrical Progreſſions continued. Which the Reader will more eaſily apprehend, when he comes to the Algebraic Part, and till then he may paſs this, if he finds it difficult to underſtand; but I could not well omit it in this place, to which it moſt properly belongs.

SECT.

SECT. III. *Rules of Proportion.*

IN this Section I shall shew the Operation, 1. Of the single Rule of Direct Proportion. 2. The single Rule of Reverse Proportion. 3. The double Rule of Direct Proportion. 4. The double Rule of Reverse Proportion. 5. The Rule of Proportion by 5 Numbers Direct. 6. The double Rule by 5 Numbers Reverse. 7. A third Variety thereof. 8. Duplicate Proportion Direct. 9. Duplicate Proportion Reverse. 10. Triplicate Proportion. 11. Harmonical Proportion. And, 12. Sesquiplicate Proportion.

I. *The Single Rule of Direct Proportion.*

This Rule has its Foundation from the 8th and 10th Propositions last foregoing, and is demonstrated by *Euclid* in the *16. 6.*

The main difficulty is to state the 3 Numbers given right; for there are always 3 given to find a 4th, and hence some call this *the Rule of 3*; others, because of its great Use, have termed it *the Golden Rule*: and 'tis called the Rule of Proportion, because the Number sought bears such Proportion to the 3d, as the 2d does to the first of the Numbers given.

For the right disposing or placing the 3 Numbers given.

Rule.] There being always 2 of one Denomination, and 1 of another, put the last mention'd down first: 2dly, Put that towards the left hand thereof which has dependance on it: and, 3dly, Put the other next the right hand. Thus if the Interest of *l.* 750 were sought for a Year at the Rate of 5 *per Cent.* it appears by the State in the Margin, that only 1 of the 3 given Numbers is Interest, therefore I place that in the middle. And because 100 has dependance on it (as being its Principal) therefore I put 100 towards the left hand, and the 3d toward the right hand (incourse.) Then

l. Princ.	*l.* Inter.	*l.* Princ.
100.	5	750
		5
		3750
		100
	37 50/100	Answer.

To find the 4th Proportional, or Answer to the Question.

Rule.] *Multiply the 2d and 3d (or those towards the right hand) together, and divide the Product by the first (or that next the left hand) and the Quotient is the Answer, or the 4th Proportional sought for.* So in the

Example above, the 4th Proportional is $37\frac{5}{10}$ for 100. 5 :: 750. $37\frac{5}{10}$, that is, as 100 is in proportion to 5, so is 750 to $37\frac{5}{10}$. So that you may prove this Rule by comparing the Product of the 1st and 4th with the Product of the 2d and 3d; as by the sixth last mention'd Prop. in Geometrical Progression.

Case 2.] When the first Number is a Unit only, the Work is done by Multiplication alone.

Thus if 1 Piece of Broad-Cloth cost 17 *l.* what will 71 cost? Here the 4th Number is found 1207 *l.* which is the 4th Proportional sought.

Pc.	*l.*	Pc.	*l.*
1	17	:: 71.	1207

17
71
497
71
1207

2*dly*, If I give 3 *s.* 9 *d.* for an Ell of Holland, what will $1371\frac{1}{8}$ cost at that rate?

By the Rule above the Question is stated as in the Margin, and you may multiply $1371\frac{3}{8}$ by 3 *s.* $\frac{9}{12}$, as in the 4th Example of Multiplication of Fractions, and the Answer is $493695\frac{5}{96}$ Shillings; which, *by the* 5*th Case of Reduction of Vulgar Fractions*, is *l.* 257 : 2 : 7 : $3\frac{1}{2}$, as *per* Margin. But these Questions are sooner solved by Practice, as *per* the next Section.

Ell	*s.*	*d.*	Ells
1.	3	: 9 ::	$1371\frac{1}{8}$

96) 493695 (5142 *s.*
480
136
96
409
384
255
192
63 *s.* Rem.
12 Mult.
96) 756 (7 *d.*
672
84 *d.* Rem.
4 Mult.
96) 336 (3 *q.* $\frac{48}{96}$
288
48

Case 3.] When the 3d Number is only a Unit, the Question is answered by Division. Thus if I give *l.* 257 : 2 : 7 . $3\frac{1}{2}$ for $1371\frac{3}{8}$ Ells of Holland, what is that *per* Ell?

The Question is thus stated: and being divided (as *per* the first Example of Division of Vulgar Fractions) the 2d by the 1st, the Quotient is $\frac{3949560}{10532176}$ *s.* which by the said 5th Case of Reduction of Vulgar Fractions is 3 *s.* 9 *d.* and proves the Truth of the last Question.

Ells	Shill.	Ell
$1097\frac{1}{8}$	$493695\frac{5}{96}$ ::	1
		84 *d.*

Note, That where the first, or third Number, or both, are of diverse Denominations, you must reduce both such 1st and 3d into the least Name mentioned in either, and then

then multiply by the ſecond Number in the loweſt Denomination that is in it when given. And then having divided by the firſt,

Note, 2dly, That your firſt Quotient will always be of the ſame Denomination with the loweſt mention'd and given in your ſecond Number. To illuſtrate theſe three Caſes,

Caſe 4.] If I give *l.* 7 for the Intereſt of *l.* 100 : 10 : — : what muſt I give for the Intereſt of *l.* 30 for the ſame time? See the Work in the Margin, where tho the 1ſt and 3d be reduced to Shillings (that being the leaſt Term in the 1ſt Number) yet the Anſwer retains the ſame Denomination with the 2d Number, and is *l.* $2\frac{1}{2\cdot1}$; or by the 5th Caſe of Reduction of Vulgar Fractions *l.* 2 : 1 : $9\frac{1}{2}$ prope.

Prin. *l.* *s.*	*l.* Int.	*l.* Prin.
100 : 10.	7 ::	30
20		20
2010 Shil.		600 Shil.
		7
		2010) 4200 (2 *l.* Inter.
		18

Caſe 5.] If I give 7 *l.* for 30 Ounces of Silver, what will 7 Ounces and 10 Penny-weight coſt at that rate?

Here it's plain that becauſe the 7 ℥. 10 dw. are reduced into Penny-weight, the 30 ℥ muſt be ſo too: Alſo that the Quote is of the ſame Denomination with the 2d Number, *viz.* *l.* $1\frac{3}{4}$; or, being reduced as aforeſaid, *l.* 1 : 15.

℥. *l.*	℥ dw.
30. 7 ::	7 : 10
20	20
600 dw.	150 Penny-weight.
	7
	600) 1050 (1 *l.*
	450
	20
	600) 9000 (15 *s.*
	30
	0

Caſe 6.] If 25 Ounces of Ambergreaſe coſt *l.* 52 : 6 : 8, what will 2 Ounces coſt?

See

See the Operation, where the 2d Number in its leaſt Denomination being 12560 Pence; therefore the Quote 1004 is Pence.

℥	l.	s.	d.	℥
25.	52	: 6 :	8.	2

20

1046 s.

12

12560 Pence } Mult.
2 Ounces }

25) 25120 (1004$\frac{20}{25}$ Pence.

120 or *l.* 4 : 3 : 8$\frac{4}{5}$ the Anſwer.

20

II. *The Single Rule of Proportion Reverſe.*

This teaches, upon a due ſtating of the 3 Numbers, to find a 4th; which ſhall bear ſuch a Ratio to the 2d, as the 1ſt does to the 3d Number.

Queſt. 1. How much Matting of 2 Foot broad will line a Gallery which is 7 Foot broad and 40 Foot long?

To ſtate a Queſtion in this Rule,

1. Put down the Number which has the ſame Denomination as that required.

2. Towards the left hand put down that Number which is joined in the Senſe of the Queſtion to the laſt.

broad.	long.	broad.	long.
7.	40.	2.	140

7

2) 280 (140 = the Anſwer.

And as 140. 40 : : 7. 2

3. Put down the other which has the ſame Denomination as that towards the left hand.

Then to find the Anſwer by this,

Rule.] Multiply the 2 next the left hand one in the other, and divide the Product by the 3d, or that next the right hand, and the Quotient is the Anſwer.

Hence the Reaſon is evident why this Rule is ſaid to be Reverſe: becauſe the leſſer the 3d Number is, the greater is the 4th; but in Direct

Direct Proportion the greater the 3d is, the greater is the 4th Number.

So that by this Rule it's eaſy to know when a Queſtion is to be ſolved as Direct, and when 'tis Reverſe: For when the 3d Number is leſs than the firſt, and yet requires more than it does, or being more, requires leſs than the firſt requires; in theſe Caſes your Proportion is Reverſe, and ſo you are to work by the laſt Rule.

Examp. 2.] How much Ground in length, being 12 Perches broad, will make an Acre?

To do this, conſider that 4 Perches in breadth requires 40 in length to make an Acre; therefore ſtate and work as *per* Margin.

long.	broad.
4.	40. 12.
4	
12) 160 (13⅓ Perches long, for Anſwer.	
40	
4	

But altho Writers have preſcribed the foregoing Method for ſtating a Queſtion, as being very natural, and thereby have made it neceſſary to make this a different kind of Operation and Proportion; yet I ſhall ſhew

How to reduce Queſtions commonly ſaid to be in Reverſe Proportion into Direct.

And this is only to conſider (to inſtance in the laſt Example)

That as (12) the Breadth on which the Anſwer depends,

Is to (4) the Breadth belonging to the Length given: :

So is (40) the Length given,

To (13⅓) the Length required.

Breadth.	Bread.	Length.	Len.
12.	4 ::	40.	13⅓

Here the 4 Numbers are in Direct Proportion, becauſe the Product of the 2 Means is equal to that of the 2 Extremes; *which by the by ſerves for Proof of this Direct Proportion.* But in the Reverſe the Product of the 1ſt and 2d is equal to that of the 3d and 4th Numbers; *which proves the Reverſe Proportion.*

III. *The Double Rule of Direct Proportion.*

This is when a Queſtion requires to be twice ſtated, and has two ſuch Operations, as under the ſingle Rule. For example,

If I give 5 *l.* for the Intereſt of *l.* 100 for one Year, what Intereſt will *l.* 700 gain at that rate in ſeven Months?

1ſt

1ſt ſay, If *l.* 100 require *l.* 5, what will *l.* 700 require in the ſame time? You find as *per* the Margin that it will gain *L.* 35.

l.	*l.*	*l.*
100.	5 ::	700
		5
		l. 3500

2dly ſay, If 12 Months require *l.* 35, what will 7 Months require? Work and you find the Anſwer *l.* $20\frac{5}{12}$, or *l.* 20 : 8 : 4.

Mon.	*l.*	Mon.
12.	35 ::	7
		7
		l.
12)	245	($20\frac{5}{12}$
		5

And by the ſame Rule you may find the Intereſt of any Sum for any Number of Days; as ſuppoſe *l.* 700 for 119 Days.

For a Year, by the firſt Operation, the Intereſt is *l.* 35: then in the ſecond Working ſay, if 365 Days requires *l.* 35, what will 119 Days require? You'll find the Anſwer to be *l.* 11 : 8 : 2 : $2\frac{19}{365}$.

Days.	*l.*	Days.
365.	35 ::	119

IV. *The Double Rule of Reverſe Proportion.*

This is alſo performed at two Operations, the firſt Direct, the latter Reverſe. For inſtance,

What Principal will gain *l.* $20\frac{5}{12}$ in 7 Months, at the Rate of 5 *per Cent?*

The 1ſt Anſwer is, that $245\frac{00}{60}$ *l.* Principal will raiſe the $20\frac{5}{12}$ in a Year.

	l. Int.	*l.* Princ.	*l.* Int.	Princ.
1ſt ſay	5.	100 ::	$20\frac{5}{12}$.	$245\frac{00}{60}$ *l.*

The 2d, or Anſwer to the Queſtion, is, That *l.* 700 is the Principal that will raiſe the Intereſt *l.* $20\frac{5}{12}$ in 7 Months: by multiplying the 2d Number by 12, and dividing by 7. *Note,* This proves the firſt Queſtion in the third Head above.

	Mon.	*l.*	Mon.	*l.*
2dly ſay	12.	$245\frac{00}{60}$:	7.	700

V. *The Rule of Proportion by 5 Numbers Direct.*

This Rule hath 5 Numbers given to find a 6th. It is the ſame with the double Rule of Proportion Direct; only whereas that was done

done by twice ſtating the Queſtion, this is done by one ſtating: *the Rule for which is to place the* 5 *Numbers as followeth.* Where it's obvious, That the 3d muſt be of the ſame Denomination with that ſought; the 1ſt and 2d are the 2 on which the 3d depends: ſo that the 4th muſt be of the ſame Denomination with the 1ſt, and the 5th the ſame with the 2d.

l. Prin.	*Time.*	*l. Int.*	*l. Prin.*	*Time.*
100.	12.	5.	700.	7
12			7 multiply.	
1200 = the Diviſor.			4900 } 5 } multiply.	

1200) 24500 (20$\frac{5}{12}$ = the Anſwer.

Example.] What is the Intereſt of *l.* 700 for 7 Months at the Rate of 5 *per Cent. per Ann?* By the Work in the Margin, you ſee

The Rule for the Operation is, Multiply the 3 Numbers next the right in each other for a Dividend, and the 2 next the left hand for a Diviſor, and the Quotient is the 6th Proportional ſought; as appears in the Method, by double ſtating under Head III.

And to prove this; The Product of the 1ſt, 2d, and 6th, is equal to that of the 3d, 4th, and 5th.

Queſt. 2.] If 1000 Men in 24 Hours can dig a Trench 18 foot broad, 9 deep, and 500 long; what length of the like Trench can 9800 Men dig in 10 Hours? The Anſwer as *per* Margin, is 2041$\frac{2}{3}$ Feet.

Men.	*Hours.*	*Feet.*	*Men.*	*Hours.*
1000.	24.	500.	9800.	10
24			10 multiply.	
			98000 } 500 } multiply.	

24000) 49000000 (2041$\frac{2}{3}$ foot Anſwer.

100

40

16

Whence it appears, That as the Product of the 1ſt and 2d Numbers is to the 3d: ſo is the Product of the 4th and 5th to the 6th Number. *Which alſo ſerves to prove the Rule*;

For as 24000. 500 :: 98000. 2041$\frac{2}{3}$.

And 24000 multiplied in 2041$\frac{2}{3}$ is equal to 98000 multiplied by 500, *viz.* 49000000, as *per* Prop. 6. of Geom. Progreſſion.

VI. *The ſecond Variety of the Rule of Proportion by* 5 *Numbers.*

This is commonly called *the Rule by* 5 *Numbers Reverſe.*

Example.] How many Men can dig $2041\frac{2}{3}$ feet in 10 Hours, at the rate of 1000 digging 500 foot in 24 Hours. *State your Queſtion thus:*

Men.	*Hours.*	*Feet.*	*Feet.*	*Hours.*
1000 :	24 :	500.	$2041\frac{2}{3}$	10

i. e. If 1000 Men in 24 Hours dig a Trench of 500 Feet in length, how many Men can dig a Trench of $2041\frac{2}{3}$ foot long in 10 Hours?

To anſwer this, multiply the 1ſt, 2d, and 4th Numbers together for a Dividend, which divide by 5000, the Product of the 3d and 5th Numbers, and the Quotient is 9800 Men for Anſwer.

VII. *A Third Variety of the Rule of Proportion by* 5 *Numbers.*

This (altho omitted by Authors) is as likely to be uſed as the laſt: for (to put the ſame Queſtion again, that the varying may the better appear)

If 1000 Men in 24 Hours can dig 500 foot of a Trench, (as mention'd under the 5th Head above;) in how many Hours can 9800 Men dig $2041\frac{2}{3}$ feet (of the like Trench?)

Men.	*Hours.*	*Feet.*	*Men.*	*Feet.*
1000 :	24 :	500.	9800.	$2041\frac{2}{3}$

Rule.] Multiply the 1ſt, 2d, and 5th together, produceth 49000000 for a Dividend: Then multiply the 3d and 4th together for a Diviſor, which is 4900000. So the Quote is 10 Hours, as in the two Caſes above.

In the	1ſt Caſe the Feet to be digged was ſought, and found	$2041\frac{2}{3}$ Feet.
	2d ..... the Number of Men to dig the larger Trench in the leſſer Time, and found	9800 Men.
	3d ..... the Time in which the larger Number could dig the larger Trench, and found	10 Hours.

For Proof of the 2*d Variety or Kind of Proportion by* 5 *Numbers:* The Product made of the 1ſt, 2d, and 4th, is equal to that of the 3d, 5th, and 6th.

And for Proof of the 3*d Variety:* The Product under the 3d, 4th, and 6th, is equal to that of the 1ſt, 2d, and 5th.

VIII.

VIII. *Of Duplicate Proportion Direct.*

This differs from the ſingle Rule of Proportion Direct, in this: 2 of the 3 (the 1ſt and 3d) requiring to be ſquared, when that ſought (or the 4th Number) is not a Square, and 1, *viz.* the middle or 2d Number, when that ſought is a ſquare Number, (or one whoſe Root muſt be extracted to give the ſpecifick Anſwer.)

Or elſe it is when the Ratio is as the Square of one thing is to that of another, *&c.*

Examples.

The Diameter of a Circle being 2, the Area is $3\frac{1416}{10000}$: therefore

What is the Area or ſuperficial Content of a Circle, whoſe Diameter is 8?

The Sqr. of the Diam.	*The Area.*		*The Sqr. of the Diam.*	*The Area.*
4.	$3\frac{1416}{10000}$	::	64.	$50\frac{2656}{10000}$

The Rule for ſtating the Queſtion is the ſame as for the ſingle Rule Direct: And the Diameters being ſquared as you ſee (4 being the Square of 2, and 64 of 8) *the Rule for performing the Operation* is the ſame as for ſingle Direct Proportion; for $3\frac{1416}{10000}$ multiplied by 64, and that Product divided by 4, the Quotient is $50\frac{2656}{10000}$ for Anſwer. For

Euclid has demonſtrated, that Circles are in proportion as the Squares of their Diameters; and accordingly, by this Proportion above we find the Area of a Circle $50\frac{2656}{10000}$, whoſe Diameter is 8.

Example 2.] What is the Diameter of a Circle, whoſe Area is $50\frac{2656}{10000}$? ſuppoſing the Diameter of a Circle, whoſe Area is $3\frac{1416}{10000}$, be 2, (as it really is.)

This is ſtated as *per* Margin, and the Operation done as before. For

The Area.		*The Sqr. of the Diam.*	*The Area.*		*The Sqr. of the Diam.*
$3\frac{1416}{10000}$.	::	4	$50\frac{2656}{10000}$.	::	64

As $3\frac{1416}{10000}$ (the Area of a Circle)
Is to 4 (the Square of that Circle's Diameter:)
So is $50\frac{2656}{10000}$ (or the Area of any other Circle)
To (64) the Square of the Diameter of that Circle.

Now extract the Square Root of 64, and you have the Anſwer, *viz.* 8.

This and the laſt Example prove each other.

IX. *Duplicate Proportion Reverſe.*

Example.] Admit the Pendulum of our common Clocks is 39 Inches, (as it is very little more) we know that ſuch a Clock vibrateth Seconds, (or 60 times in a Minute.) Now what is the Length of a Pendulum that vibrateth Half-Seconds, (or 120 times in a Minute?)

Queſtions under this Rule are moſt naturally ſtated as in ſingle Reverſe Proportion above; and being ſo ſtated, muſt be ſo wrought after the Vibrations are ſquared. By this State it appears that the Proportion is Reverſe: for if 60 Vibrations require a Pendulum 39 Inches long, it's plain that a Clock, whoſe Vibrations are 120 in a Minute, muſt have its Pendulum ſhorter, (for the longer the Pendulum, the fewer the Vibrations in a Minute; and the contrary:) therefore more requiring leſs, ſhews the greater Extreme (or 120) muſt be your Diviſor, as appears by what is ſaid under the firſt Example of ſingle Reverſe Proportion. So that multiplying the Square of 60 = 3600 by 39, and dividing the Product by the Square of 120 = 14400, the Quotient or Anſwer is $9\frac{3}{4}$ Inches.

Vibrations.	*Inches.*	*Vibrat.*	*Inches.*
60.	39.	120.	$9\frac{3}{4}$

Example 2.] A Pendulum of 39 Inches vibrating 60 times in a Minute; how many times does that Pendulum vibrate in a Minute, whoſe Length is $9\frac{3}{4}$?

Here, by multiplying the two firſt towards the left hand together, *viz.* 39 and 3600 = (the Square of 60) and dividing the Product by $9\frac{3}{4}$ (as taught in Diviſion of Vulgar Fractions) the Quotient is 14400, the Square of the Anſwer: therefore extract the Square Root of 14400, and you'll find it 120 = the Number of Vibrations in a Minute of a Pendulum whoſe Length is $9\frac{3}{4}$ Inches.

Inches.	*The Sqr. of the Vibrat.*	*Inches.*	*The Sqr. of the Vibrat.*
39.	3600.	$9\frac{3}{4}$	14400

Example 3.] Admit a Body on the Surface of the Earth (or 4000 Miles diſtant from the Center thereof) weigh 20 Hundred weight, what will that Body weigh if it were 12000 miles above the Surface, or 16000 from the Center of it? State your Queſtion thus;

Miles.	*C.wt.*	*Miles.*
4000	20	16000

Mul-

Multiply the Square of the 1ſt by the 2d, and divide the Product by the Square of the 3d, and the Quote is $1\frac{1}{4}$ C. Which ſhews, that a Ton weight, if 12000 miles high, will weigh but $1\frac{1}{4}$ C. and if 189314 miles high, 'twill weigh but a Pound, by the ſame Rule. So likewiſe the Velocity or Swiftneſs of Deſcent is alſo in proportion to a heavy Body's diſtance from the Center of the Earth in a duplicate Ratio: for the Celerity of the Fall on the Earth (or 4000 miles from the Center) being 16 foot in a Second; if the ſame Body be 16000 miles from the Center, it will fall but 1 foot in a Second, as you may eaſily prove by this preſent Rule, as aboveſaid.

I have given an Example under the ſingle Rule of Proportion Reverſe, how theſe laſt, *&c.* may be performed as in Direct Proportion, by ſaying (in the 2d Example)

As $9\frac{3}{4}$. to 39 :: ſo 3600. to 14400, whoſe Root is 120.

But then this neither agrees, as to ſtating the Queſtion, with the Rules given for that purpoſe under the ſingle Rules Direct nor Reverſe, and conſequently theſe Queſtions are moſt properly and naturally to be performed as directed above, as agreeing with the Rules given for ſtating and working ſuch Queſtions.

X. *Triplicate Proportion.*

As in Duplicate Proportion the Ratio is as the Square of one Number is to another Number, or the contrary; ſo this kind, the Ratio is as one Number is to the Cube of another, or as the Cube of one Number is to ſome other Number.

Example 1.] If a Sphere (or Ball) which is 8 Inches Diameter, weigh 48 Pounds; what will another Sphere of the ſame Specie of Matter weigh, whoſe Diameter is 4 Inches?

This is a ſingle direct Proportion, (working with the Cubes of the Diameters) where the 4th Proportional is found lb 6. For

The Cube of the Diam. 8.	lb *its Weight.*	*The Cube of the Diam.* 4.
512.	48 ::	64.

As 512 = (the Cube of the Diameter 8.) is to 48 Pounds weight,
So is 64 (the Cube of the Diameter 4.) to 6 Pounds, the Weight required.

Example 2.] If a Sphere weighing 48 lb. be 8 Inches Diameter, what is the Diameter of another Sphere of the ſame Matter, whoſe Weight is 6 lb?

Here

Here by multiplying the 2d and 3d Numbers together, and dividing the Product by the 1ſt; the 4th Proportional is 64, the Cube Root whereof is 4 = the Anſwer. For

lb *the Weight.*	*The Cube of the Diam.* 8.	lb *the Weight.*
48.	512 ::	6.

As 48 Pounds weight is to 512 (the Cube of the Diameter 8)
So is 6 Pounds weight to 64 (the Cube of the Diameter ſought) whoſe Root is 4.

And as the Weight, ſo the Solidity of Spheres is found by the ſame Ratio.

Example 3.] Admit the ſolid Content of a Sphere be $4\frac{1888}{1000}$, whoſe Diameter is 2; what is the Solidity of another Sphere, whoſe Diameter is 4?

The Cube of the Diam. 2.	*The Solidity.*	*The Cube of the Diam.* 4.	*The Solidity.*
8.	$4\frac{1888}{1000}$ ::	64.	$33\frac{5104}{1000}$

Here you ſee that As the Cube of the Diameter 2, *viz.* 8.
Is to the Solidity of that Sphere $4\frac{1888}{1000}$:
So is the Cube of the Diameter 4, *viz.* 64.
To the ſolid Content of that Sphere, *viz.* $33\frac{5104}{1000}$.

Example 4.] The Diameter of a Sphere being 2, whoſe Solidity is $4\frac{1888}{1000}$; what is the Diameter of another Sphere, whoſe Solidity is $33\frac{5104}{1000}$? Anſw. 4; the Cube Root of 64: for as $4\frac{1888}{1000}$. 8 :: $33\frac{5104}{1000}$. 64.

XI. *Harmonical Proportion.*

In this kind of Proportion there are 3 Numbers given to find a 4th, which ſhall bear ſuch direct Proportion to the firſt, as the Difference between the 3d and 4th bears to the Difference between the 1ſt and 2d.

It is called Harmonical (or Muſical Proportion) probably by reaſon of the double Ratio of the Numbers among themſelves.

The Rule to find the 4th Proportional, is, Multiply the 1ſt and 3d together, and divide the Product by double the 1ſt, leſs the 2d; and the Quotient is the 4th Number required.

Example.] What is the 4th Proportional Harmonical to theſe 3 Numbers 7 : 10 : 12? Anſw. 21.

See the Work in the Margin.

For Proof of this, as aboveſaid :

21. 7 :: 9. 3

That is, as 21, the 4th Number (or that required in the Queſtion) is to 7 (the 1ſt Number) ſo is the Difference between 12 and 21, *viz.* 9. to the Difference between the 1ſt and 2d, or 7 and 10, *viz.* 3.

7 : 10 : 12 : 21	
2	7
Product 14	= 4) 84 (21
Leſs 10	
Reſts 4.	4
	0

Hence as a Corollary it will appear, That double the 1ſt Number muſt exceed the 2d Number, otherways you'll want a Diviſor, and cannot find the requiſite Number without the Arithmetic of Negatives.

XII. *Seſquiplicate Proportion.*

In this kind of Ratio the Square of one Number is in proportion to the Cube of another, and the contrary.

It is uſed in finding the Diſtance of the Planets in the Solar Syſtem from the Sun their Center, about which they revolve : For

As the Square of the Time in which any Planet finiſheth its Periodical Revolution,

Is to the Cube of its Diſtance from the Sun : :

So is the Square of any other Planet's Time

To the Cube of its Diſtance. Thus

	Days.		*Miles.*
The Earth finiſhes its Period in	$365\frac{1}{4}$	And its Diſtance from the Sun is	86000000
Mars	625	about	130000000
Jupiter	4333		440000000
&c.			

Sect. IV. *Rules of Practice.*

THIS is a briefer Method of caſting up any Quantity of Merchandize than the Rule (commonly uſed) of Proportion or Multiplication. And 'tis done by conſidering what even Parts of a Pound the given Price is, or is reducible to, and then framing a Rule accordingly.

It

It is called the Rule of Practice becauſe of its excellent Uſe in the Practice of Merchandize, for diſpatching many Computations with much eaſe and in a ſhort time.

I ſhall not trouble the Reader with ſhewing him a Table of the even Parts of a Shilling or a Pound, by reaſon I have given an intire Table, with the Fabrick thereof, at the end of Diviſion, and have reduced the whole Buſineſs of Practice into Rules ariſing gradually in the Value of the Integer in ſo regular and copious a Method, that any one may eaſily find his Rate or Value of the Yard, Ell, Pound, Ounce, *&c.* and right againſt it a Rule how to perform the Operation after the beſt and moſt conciſe manner. And he will generally know which are the even Parts of a Pound by the Shortneſs of the Rule, being only one Diviſion required to bring the given Number into Pounds reſpectively. I have mark'd the Aliquot Parts of a Pound with *A. P. L.* in the Table: And I think I may affirm, that this moſt copious, regular, and ſhort Way of Practice, was firſt (and only) ſhewn by myſelf, where I take no notice of the Parts of a Shilling, but of a Pound only.

The main thing that makes the Rules of Practice preferable, is the performing the Operation mentally, without putting down any Figures but the Quotients or Anſwers for the moſt part: And this is done by chuſing proper Diviſors, few or none of which exceed 12; to which Number incluſive my Multiplication-Table foregoing extends, and is ſuppoſed to be perfectly in the Reader's memory.

But before I proceed to the Tables, it will be neceſſary to give *theſe previous Caſes.*

Caſe 1.] *When the Value of the Integer is* 2*s.* you have the Anſwer by only cutting off the Units place (or dividing by 10) 2 *s.* being the 10th part of a Pound; and the Figure in Units place is ſo many two Shillings. Thus 34765 Ells at 2*s.* each is *l.* 3476 : 10; thoſe to the left hand Units place being ſo many Pounds. So alſo 9734 at 2*s.* is *l.* 973 : 8 : —; and 875 is *l.* 87 : 10 : —

Caſe 2.] From the laſt Caſe it will follow, *that if the Price is an even Number of Shillings for the Unit*; the whole Parcel will be half ſo many Shillings as the Value of the Unit is, multiplied in what ſuch Parcel would amount to at 2*s.* Thus 7876 at 18*s.* is *l.* 7876 at 2*s.* therefore it is 9 times that at 18*s.* So multiply 7876 by 9 thus,

9 times

9 times 6 (cut off) is 54 two Shillings, put down 8 *s.* and carry *l.* 5; then 9 times 7 *l.* is 63, and 5 carried is 68; and ſo proceed to multiply the 78, and you'll find the Anſwer to be *l.* 7088 : 8 : — And by the ſame Rule 19468 at 16 *s.* is *l.* 15574 : 8 : — I ſay 8 times 8 is 64, twice the 4 is 8 *s.* and carry *l.* 6, &c. Likewiſe 97357 at 14 *s.* is *l.* 68149 : 18 : — &c.

Caſe 3.] *When the Value of the Integer or Unit is* 1 s. what is the Value of 135694?

135694

You muſt take a 20th part, cutting off Units place, and taking half what reſts to the left hand, as half 13 is 6, $\frac{1}{2}$ of 15 is 7, $\frac{1}{2}$ of 16 is 8, and $\frac{1}{2}$ of 9 is 4, and the 10 *s.* remaining, and the 4 cut off is 14 *s.* becauſe the Value at 1 *s. per* Unit is half as much as at 2 *s.*

Anſwer *l.* 6784 : 14 : —

Caſe 4.] *When the Price of the Unit is* 6 *d.* take a 40th of the given Number, which ſuppoſe 17372, cut off the 2 from 17372, and take a 4th of the reſt: So the Anſwer at one Work is *l.* 434 : 6 *s.* for 12 Sixpences remains. For 4 in 17 is 4, 4 in 13 is 3, and 4 in 17 is 4, the 434 *l.*

Caſe 5.] *When the Price of the Unit is* 4 *d.* and you are directed to take a 60th part of the given Number, which ſuppoſe 5567

Here the Units place being cut off, I take a 6th of what is to the left hand the daſh, thus 6 in 55 is 9, and reſts 1; 6 in 16 is 2, and there reſts 4, which with the 7 is 47 Groats, or 15 *s.* 8 *d.* the Anſwer.

$\frac{1}{60}$ is *l.* 92 : 15 : 8

Caſe 6.] *When the Value of the Unit is* 3 *d.* and you are directed in the ſubſequent Rules to take $\frac{1}{80}$ of the given Number, which ſuppoſe 7539; cut off the Units place, and take $\frac{1}{8}$ of the remaining Figures, as 8 in 75 is 9, 8 in 33 is 4, and 19 Three-pences (or 4 *s.* 9 *d.*) over.

7539

$\frac{1}{80}$ is *l.* 94 : 4 : 9

Caſe 7.] *When the Price of the Unit is* 2 *d.* and you are directed to take $\frac{1}{120}$ of the given Number, which ſuppoſe 19739; cut off the 9 in Units place, and take $\frac{1}{12}$ of the reſt: ſo 12 in 19 is 1, 12 in 77 is 6, 12 in 53 is 4, and 59 Two-pences reſts, or 9 *s.* 10 *d.* And that the Remainers in theſe

19739

$\frac{1}{120}$ = *l.* 164 : 9 : 10,

four laſt Caſes may not, when large, ſeem difficult to caſt up, I ſhall ſubjoin *this little Table of Remainers* in Shillings and Pence.

Remainers.	*Two-pences.*	*Three-pences.*	*Four-pences.*	*Six-pences.*
10	1 *s.* 8 *d.*	2 *s.* 6 *d.*	3 *s.* 4 *d.*	5 *s.* 0 *d.*
20	3 4	5 0	6 8	10 0
30	5 0	7 6	10 0	15 0
40	6 8	10 0	13 4	
50	8 4	12 6	16 8	
60	10 0	15 0		
70	11 8	17 6		
80	13 4			
90	15 0			
100	16 8			
110	18 4			

Thus by this Table the 47 Groats which remained in the 5th Caſe above, is 15 *s.* 8 *d.* for 40 under Four-pences is 13 *s.* 4 *d.* and 7 Groats (or 2 *s.* 4 *d.*) is 15 *s.* 8 *d.*

Note 1. That the Remainers are of the ſame Denomination with the Dividends: As in the Example to the 5th Rule I ſuppoſe in the firſt Operation the Dividend Two-pences, and therefore dividing by 120, I find 47 Two-pences remaining, or 7 *s.* 10 *d.* And what remains after in taking any part of the Quotients, are Pounds, Shillings, or Pence, as thoſe Quotients are. The Caſes above, and the Rules and Examples following, make this very evident.

Here

The Value of the Pound, Ell, Yard, &c. s. d. qr.	*Here followeth 149 Rules (with Examples for such as seem the most difficult) for the brief working by Practice to give the Answer in Pounds, &c. the like not extant, by any other Hand.*	*Number of Rules.*
A. P. L. 1	Take $\frac{1}{8^0}$ of $\frac{1}{12}$ of the given Number (or $\frac{1}{9^6^0}$ thereof)	1
A. P. L. 2	Take an 80th of a 6th of the given Number ——	2
A. P. L. 3	Take $\frac{1}{8^0}$ of $\frac{1}{4}$ of the given Number (or $\frac{1}{3^2^0}$ thereof)	3
A. P. L. —: 1 :-	Take a 20th of a 12th of the given Number, or take an 120th and deduct $\frac{1}{2}$ thereof ——	4
A. P. L. 1:1	To $\frac{1}{2}$ of 120th of the given Numb. add a 4th of that $\frac{1}{2}$	5
A. P. L. 1:2	Take a 20th of an 8th of the given Number, or $\frac{1}{1^6^0}$ ——	6
1:3	From 120th of the given Number take an 8th of that 120th ——	7
A. P. L. 2:-	Take an 120th of the given Number ——	8
2:1	To an 120th of the given Number add an 8th of that 120th ——	9
A. P. L. 2:2	To an 120th of the given Number add $\frac{1}{4}$ of that 120th, or take $\frac{1}{9^6}$ ——	10
2:3	From an 80th of the given Number take a 12th of that 80th ——	11
A. P. L. 3:0	Take an 80th of the given Number, as *per* Case 6. ——	12
3:1	To an 80th of the given Number add a 12th of that 80	13
3:2	To an 80th of the given Number add a 6th of that 80	14
A. P. L. 3:3	To an 80th of the given Number add a 4th of that 80th, (or take a 64th) ——	15
A. P. L. 4:-	Take a 60th of the given Number, as *per* prev. Case 5.	16
4:1	To an 120th of the given Number twice put down, add an 8th of 120th ——	17
4:2	To a 60th of the given Number add an 8th of that 60	18
4:3	To a 60th of the given Number add an 8th of that 60th, and $\frac{1}{2}$ that 8th ——	19
A. P. L. 5:-	Take an 8th of a 6th of the given Numb. or take $\frac{1}{4^8}$	20
5:1	From a 40th of the given Numb. take an 8th of that 40	21
5:2	From a 40th of the given Number take a 12th of that 40th ——	22
5:3	From an 80th of the given Number twice put down, take a 12th of an 80th ——	23
A. P. L. 6:-	Take a 40th of the given Numb. as *per* previous Case 4.	24

Example to Rule 5.

19727 at 1 *d.* 1 *q.*

$\frac{1}{1^2^0}$ = *l.* 164: 7:10

$\frac{1}{2}$ of that *l.* 82: 3:11
$\frac{1}{4}$ of that $\frac{1}{2}$ *l.* 20: 10: $11\frac{3}{4}$ } ad

Sum, *l.* 102: 14: $10\frac{3}{4}$ the Answer.

Example to Rule 17.

9376 at 4 *d.* 1 *qr.*

$\frac{1}{1^2^0}$ = *l.* 78: 2:8
ditto *l.* 78: 2:8 } ad
$\frac{1}{8}$ of $\frac{1}{1^2^0}$ *l.* 9:15:4

Sum, 166: —: 8 Anſ.

Example to Rule 23.

8935 at 5 *d.* 3 *qr.*

$\frac{1}{8^0}$ *l.* 111: 13:9
ditto 111: 13:9

Sum, *l.* 223: 7:6
$\frac{1}{1^2}$ of $\frac{1}{8^0}$ = 9: 6: $1\frac{3}{4}$ ded.

Reſts = 214: 1: $4\frac{1}{4}$ Anſ.

The Value of the Pound, Ell, Yard, &c. d. qr.	*The Continuation of the Table of Rules for the short Work of Practice, &c. as before.*	Number of Rules.
6 : 1	To an 80th of the given Number twice put down, add a 12th of an 80th.	25
6 : 2	To a 40th of the given Numb. add a 12th of that 40th.	26
6 : 3	To a 40th of the given Numb. add an 8th of that 40th.	27
7 : 0	To a 40th of the given Numb. add a 6th of that 40th.	28
7 : 1	To a 40th of the given Number, add a 6th of that 40th, and a 4th of that 6th.	29
A. P. L. 7 : 2	To a 40th of the given Number add a 4th of that 40th, (or take $\frac{1}{32}$.	30
7 : 3	To a 40th of the given Number add a 4th of that 40th, and a 6th of that 4th.	31
A. P. L. 8 : —	Take a 30th of the given Number.	32
8 : 1	From an 80th of the given Number put down 3 times, take the 4th of an 80th.	33
8 : 2	To a 60th of the given Number put down twice, add an 8th of a 60th.	34
8 : 3	From an 80th of the given Number thrice put down, take a 12th of an 80th.	35
9 : —	To a 40th of the given Number add half of that 40th.	36
9 : 1	To an 8th of the given Number thrice put down, add a 12th of an 80th.	37
9 : 2	To an 80th of the given Number thrice put down, add a 6th of an 80th.	38
9 : 3	To an 80th of the given Number thrice put down, add a 4th of an 80th.	39
A. P. L. 10 : —	Take an 8th of a 3d of the given Number, (or a 24th part.)	40
10 : 1	To a 30th of the given Number add a 4th of that 30, and an 8th of that 4th.	41
10 : 2	From a 20th of the given Numb. take an 8th of that 20.	42
10 : 3	To a 40th and a 60th of the given Number, add an 8th of that 40th.	43
11 : —	From a 20th of the given Numb. take a 12th of the 20.	44
11 : 1	From a 40th of the given Number twice put down, take an 8th of a 40th.	45
11 : 2	From a 40th of the given Number twice put down, take a 12th of a 40th.	46
11 : 3	To a 30th of the given Number add an 80th, and a 4th of that 80th.	47

Example to Rule 31.

7238 at 7 *d.* 3 *qr.*

$\frac{1}{20}$ = *l.* 180 : 19 : —	
$\frac{1}{4}$ of the 40th *l.* 45 : 4 : 9	
$\frac{1}{8}$ of the 4th *l.* 7 : 19 : $9\frac{1}{2}$	
Answer, *l.* 233 : 14 : $6\frac{1}{2}$	

Example to Rule 35.

3929 at 9 *d.* 1 *q.*

an 80th = *l.* 49 : 2 : 3	
ditto — 49 : 2 : 3	
ditto — 49 : 2 : 3	
$\frac{1}{12}$ of $\frac{1}{80}$ = 4 : 1 : $10\frac{1}{4}$	
Sum, Answ. 151 : 8 : $7\frac{1}{4}$	

Example to Rule 45.

1895 at 11 *d.* 1 *q.*

a 40th = *l.* 47 : 7 : 6	Ad
ditto = 47 : 7 : 6	
l. 94 : 15 : —	Sur
$\frac{1}{8}$ of $\frac{1}{40}$ = 5 : 18 : $5\frac{1}{4}$	Dec
Rests *l.* 88 : 16 : $6\frac{3}{4}$	Ans

Value of the Pound, Ell, Yard, &c. s. d. qr.	*A Continuation of the Table of Rules for the short Work of Practice.*	*Number of Rules.*
A. P. L. 1 : 0 : 0	Take a 20th of the given Numb. (as *per* prev. Case 3.)	48
1 : — : 1	To a 40th of the given Number, and a half of that 40th twice put down, add a 12th of one of the ½.	49
1 : — : 2	To a 40th of the given Number twice put down, add a 12th of a 40th	50
1 : — : 3	To a 40th of the given Number twice put down, add an 8th of a 40th	51
1 : 1 : —	To a 20th of the given Numb. add a 12th of that 20th.	52
1 : 1 : 1	To a 20th of the given Number add a 12th of that 20th, and a 4th of the 12th.	53
1 : 1 : 2	To a 20th of the given Numb. add an 8th of that 20th.	54
1 : 1 : 3	To a 20th of the given Number add an 8th of that 20th, and a 6th of the 8th.	55
1 : 2 : —	To a 20th of the given Numb. add a 6th of that 20th.	56
1 : 2 : 1	To a 20th of the given Number add a 6th of that 20th, and an 8th of that 6th.	57
1 : 2 : 2	To a 20th of the given Number add a 6th of that 20th, and a 4th of that 6th	58
1 : 2 : 3	To a 30th of the given Number add a 40th of it, and an 8th of the 40th	59
A. P. L. 1 : 3 : —	Take half of an 8th of the given Numb. (or a 16th)	60
1 : 3 : 1	To a 20th of the given Number add a 4th of the 20th, and a 12th of the 4th	61
1 : 3 : 2	To a 20th of the given Number add a 4th of that 20th, and a 6th of the 4th	62
1 : 3 : 3	To a 20th of the given Number add a 4th of that 20th, and a 4th of that 4th	63
A. P. L. 1 : 4 : —	Take a 30th of the given Number, and double it (or put down twice) or take a 15th of the given N°	64
1 : 4 : 1	To ½ of an 8th of the given Numb. add a 12th of that ½	65
1 : 4 : 2	To a 20th of the given Number add a 3d of that 20th, and an 8th of the 3d	66
1 : 4 : 3	To a 40th of the given Number twice put down, add a 60 of the given Numb. and an 8th of a 40th.	67
1 : 5 : —	From a 12th take an 80th of the given Number	68
1 : 5 : 1	From a 20th of the given Number added to ½ the 20th, take an 8th of that half	69
1 : 5 : 2	From a 20th of the given Number added to half that 20, take a 12th of that half	70
1 : 5 : 3	From a 20th of the given Number added to a 4th of that 20th twice put down, take a 12th of said 4th	71

Example to Rule 65.

893 at 16 *d.* ¼

an 8th = *l.* 111 : 12 : 6

½ an 8th, *l.* 55 : 16 : 3
½ of the ½ = 4 : 13 : 0¼

Answer, *l.* 60 : 9 : 3¼

Example to Rule 67.

1239 at 16 *d.* ¾

a 40th *l.* 30 : 19 : 6
ditto 30 : 19 : 6
a 60th = 20 : 13 : —
⅛ of a 40th 3 : 17 : 5¼

Sum, *l.* 86 : 9 : 5¼

Example to Rule 71.

952 at 17 *d.* ¾

a 20th *l.* 47 : 12 : —
¼ of a 20, *l.* 11 : 18 : — Ad.
ditto *l.* 11 : 18 : —

Sum, 71 : 8 : —
a 12 of a 4 — : 19 : 10 ded.

Rests *l.* 70 : 8 : 2 Answ

The Value of the Pound, Ell, Yard, &c. s.	d.	*A Continuation of the Table of Rules for the short Work of Practice.*	*Number of Rules.*
1 :	6	To a 20th add half that 20th	72
1 :	7	From a 12th of the given Number take a 20th of that 12th	73
A. P. L. 1 :	8	Take a 12th of the given Number	74
1 :	9	To a 12th of the given Numb. add a 20th of that 12th	75
1 :	10	To a 12th of the given Number add a 10th of that 12th	76
1 :	11	Add an 80th to a 12th of the given Number	77
A. P. L. 2 :	—	Take a 10th of the given Number, as *per* previous Case 1.	78
2 :	1	To a 12th of the given Number add a 4th of that 12th	79
2 :	2	To a 10th of the given Numb. add a 12th of that 10th	80
2 :	3	To a 10th of the given Number add an 8th of that 10th	81
2 :	4	To a 10th of the given Number add a 6th of that 10th	82
2 :	5	To a 12th of the given Number add a 4th of that 12th	83
A. P. L. 2 :	6	Take an 8th of the given Number	84
2 :	8	To a 10th of the given Number add a 3d of that 10th	85
2 :	9	To an 8th of the given Number add a 10th of that 8th	86
3 :	0	To a 10th of the given Number, add half that 10th	87
3 :	3	From a 6th of the given Number take a 40th of that 6th	88
A. P. L. 3 :	4	Take a 6th of the given Number	89
3 :	6	To a 6th of the given Number add a 20th of that 6th	90
3 :	8	To a 6th of the given Number add a 10th of that 6th	91
3 :	9	To a 6th of the given Number add an 8th of that 6th	92
A. P. L. 4 :	0	Take a 5th of the given Number, (or shorter) take 2 Tenths of the given Number	93
4 :	3	To a 10th of the given Number twice put down, add an 8th of a 10th	94
4 :	4	To a 10th twice put down, add a 6th of a 10th	95

Example to Rule 73.

1047 at 1 *s.* 7 *d.*

a 12th = *l.* 87 : 5 : —
a 20 of a 12, 4 : 7 : 3

Resteth *l.* 82 : 17 : 9 the Answer.

Example to Rule 88.

895 at 3 *s.* 3 *d.*

a 6th = *l.* 149 : 3 : 4
a 40th of $\frac{1}{2}$ *l.* 3 : 14 : 7 ded.

Resteth *l.* 145 : 8 : 9 the Answer.

Example to Rule 94.

739 at 4 *s.* 3 *d.*

a 10th = *l.* 73 : 18 : —
ditto *l.* 73 : 18 : — } Ad.
$\frac{1}{2}$ of a 10th, 9 : 4 : 9

Sum = 157 : — : 9 Answ.

The Value of the Pound, Ell, Yard, &c. s. d.	*A Continuation of Rules for the ſhort Work of Practice.*	*Number of Rules.*
4 : 6	To a 10th add an 8th of the given Number	96
4 : 8	To a 10th of the given Number twice put down, add a 3d of a 10th	97
4 : 9	From a 4th of the given Number take a 20th of that 4th	98
A. P. L. 5 : 0	Take a 4th of the given Number	99
5 : 6	To a 4th of the given Number add a 10th of that 4th.	100
6 : —	Take 3 Tenths of the given Number, as *per* previous Caſe 2.	101
A. P. L. 6 : 8	Take a 3d of the given Number	102
7 : —	Work for 6 *s.* and 1 *s.* as *per* previous Caſes 2, & 3.	103
7 : 6	Take an 8th of the given Number, and put it down thrice, or multiply by 3.	104
8 : —	Take 4 Tenths of the given Number, as *per* previous Caſe 2.	105
8 : 6	To 4 Tenths add a 40th of the given Number	106
9 : —	To 4 Tenths of the given Number add a 20th thereof	107
9 : 6	From half the given Number take a 20th of that half	108
A. P. L. 10 : 0	Take half the given Number	109
10 : 6	To half the given Number add a 20th of that half	110
11 : —	To half the given Number add a 10th of that half	111
11 : 6	From 6 Tenths take a 40th of the given Number	112
12 : —	Take 6 Tenths of the given Number, as *per* previous Caſe 2.	113
12 : 6	To half the given Number add a 4th of that half	114
13 : —	Take 6 Tenths of the given Number, and add to a 20th thereof	115
13 : 4	To half add a 6th of the given Number	116
14 : —	Take 7 Tenths of the given Number, as *per* previous Caſe 2.	117
14 : 6	To 7 Tenths add a 40th of the given Number	118
15 : —	To $\frac{1}{2}$ the given Number add half of that half, (or from the given Number take $\frac{1}{4}$)	119

Example to Rule 104.	*Example to Rule* 112.	*Example to Rule* 115.
559 at 7 *s.* 6 *d.*	365 at 11 *s.* 6 *d.*	169 at 13 *s.*
an 8th = *l.* 69 : 17 : 6	6, 10ths = 219 : as *p.* Caſ. 2.	6 tenths 101 : 8 : —
Multiply by 3	a 40th = *l.* 9 : 2 : 6 ded.	a 20th = *l.* 8 : 9 : —
Prod. = *l.* 209 : 12 : 6 or Anſwer.	Reſts = *l.* 209 : 17 : 6 Anſ.	Sum, *l.* 109 : 17 : — Anſ.

Note, *That A. P. L. ſignifies the Aliquot Parts of a Pound.*

The Value of the Pound, Ell, Yard, &c. s. d.

A Continuation of Rules for the ſhort Work of Practice.

Number of Rules.

15:6 From 8 Tenths (as *per* previous Caſe 2) take a 40th of the given Number — 120

16:- Take 8 Tenths of the given Number — 121

16:6 To 8 Tenths add a 40th of the given Number — 122

17:- To 8 Tenths add a 20th of the given Number — 123

17:6 From the given Number take an 8th thereof — 124

18:- Take 9 Tenths of the given Number — 125

18:6 To 9 Tenths add a 40th of the given Number — 126

19:- From the given Number take a 20th thereof — 127

19:6 From the given Number take a 40th thereof — 128

Note, That where Pounds, Shillings, &c. are the Price of a Unit; you muſt multiply the Units given by the Pounds, and work for the Shillings, &c. as before directed. *See the 2d Caſe of the next Section.*

per Cent. or 100.

The following ſhews how Intereſt, Commiſſion to Factors, Cuſtoms, &c. is caſt up by the ſhort Rules of Practice.

1 *per C.* Take the 100th part of the given Number, (as *per* Rule 3. Prop. 3. in Diviſion.) — 129

2 Take a 50th of the given Number — 130

2 ½ Take a 40th of the given Number — 131

3 To a 50th of the given Number add half that 50th — 132

4 Put down a 50th of the given Number twice — 133

4 ½ To a 50th add a 40th of the given Number — 134

5 Take a 20th of the given Number — 135

6 Take a 50th of the given Number, and put it down thrice (or multiply it by 3.) — 136

7 Add a 20th to a 50th of the given Number — 137

8 Multiply a 50th of the given Number by 4 — 138

9 From a 10th of the given Number take a 10th of the 10th — 139

10 *per Cent.* Take a 10th of the given Number — 140

Eight Examples to the Rules for finding Intereſt, &c. by Practice; viz.

What is *l.* 1541:16:3 at 1 *per* C.
100 part is *l.* 13:8:4 ¼ Anſw.

What *l.* 2132:12:6 ½ at 2 ½ *p.* C.
a 40th is *l.* 53: 6:3 ¾ Anſwer.

What 3235:17:11 ¾ at 5 *per*
a 20th is *l.* 161:15:10 ¾ Anſ

What is *l.* 879:10:7 at 6 *per* C.
a 50th = *l.* 17:11:9 ¾
Multiply by 3
Produceth 52:15:5 ¼ Anſw.

What *l.* 933: 8:10 at 7 *per* C.
a 20th *l.* 46:13: 5 ¼ } Add.
a 50th *l.* 18:13: 4 ½ }
Sum, *l.* 65: 6: 9 ¾ Anſw.

What 671:—:2 ¼ at 8 *per* Ce
a 50th *l.* 13: 8:4:3 4/10
which multiply by ..4
Prod. *l.* 53:13:7 ¼ Anſwer.

What is *l.* 472:14:5 ½ at 9 *per Cent.*
a 10th is = *l.* 47: 5:5 ¼
a 10th of that 10. *l.* 4:14:6 ½ deduct.
Reſteth = *l.* 42:10:10 ¾ the Anſwer.

What *l.* 1976:19:11 ¼ at 10 *per Cent.*
a 10th is *l.* 197:13:10 ¾ Anſwer.

See more of computing Intereſt, in the Uſe of Decimals, *Chap.* 3.

I ſhall next very briefly ſhew the Uſe of Rules of Practice in making Allowance for Tare; which is an Allowance for the Bag, or whatſoever a Commodity is pack'd up in, for ſome things more, ſome leſs. The Weight of the Goods, and what contains them, is together called the Groſs Weight, and the Weight of the Goods alone is the Nett Weight.

Goods.	*Allowance per the* 112 lb.	N° of *Rules.*	*Rules for the ſhort Working.*
Currans	lb 16	141	Take a 7th of the groſs Weight.
Almonds, Steel, Hemp	14	142	Take an 8th of the groſs Wt.
Allum, Salt-petre, Tallow,	12	143	From an 8th take a 7th of that 8th.
Brimſtone, Copperas, Copper,	8	144	Take half of a 7th of the groſs Weight.
Iron Wire, Lattin Wire	6	145	Take half of what it comes to at 12, as above.
Cotton-Wool, Lambs-Wool, and *Poliſh*-Wool, Feathers, Hops	4	146	Take a 4th of a 7th of the groſs Weight.
Cotton-Yarn 5 lb at 100 weight.		147	Take a 20th, or half a 10th of the groſs Weight.
		148	A General Rule (eſpecially for ſuch Rates of Tare as are moſt remote from being Aliquot Parts of 112 lb; ſuch as 3, 5, 9, 11, *&c.*) is this. Multiply the groſs Hundreds by the Pounds to be allowed for 1 *C.* and for the Quarters of Hundreds and Pounds take a Part proportionable of the Allowance *per* Hundred, and the Sum is an eaſy way of giving the Anſwer.

Example to Rule 143.

	C.	*qr.*	lb.
Groſs	29	3	24 at 12 *per C.*
$\frac{1}{8}$ is	3	2	$27\frac{1}{2}$
a 7th of that 8,	0	2	$3\frac{3}{4}$ ded. from the 8th.
Reſteth Tare	3	—	$23\frac{3}{4}$ = Anſw.
or the Nett Weight	26	3	— $\frac{1}{4}$; the Groſs, leſs the Tare.

Example to Rule 145.

	C.	qr.	lb.	
Grols	37	2	12	at 12 lb *per* C.
$\frac{1}{8}$ is	4	2	22	
a 7th of that 8, —		2	19	deduct from the 8th.
Refts =	4	-	3	= the Tare at 12 *per* C.
$\frac{1}{2}$ of that is	2	-	$1\frac{1}{2}$	the Tare at 6 *per* C. = Anf.
And if ded. there refts	35	2	$10\frac{1}{2}$	Nett Weight

The Example to Rule 143. *done according to this General Rule* 148.

Multip. { 29 : 3 : 24 at 12 *per* C. or 112 lb. / 12

Prod. = 348 lb. for the 3 qs. 9 the lb 24, $2\frac{3}{4}$

lb $359\frac{3}{4}$ Sum, or 3 C. — qr. $23\frac{3}{4}$ lb. as before.

For Oil imported there is allowed 18 *per Cent.* (or 112 lb.) Tare: Now suppose I import 180 Hund. wt. how many Nett Tons and Gallons is there?

The Proof, viz.

C.	q.	lb.	
180	: 0	: 0	Grols.
Ton 9	: 00		Gall.
Deduct	12		
Ton Nett 8	: 240		Gal. Anf.

Multiply { 180 Hundr. Grols. / 94 lb *per* Nett Hundr.

72

162

Gall.

lb *per* Gal. = $7\frac{1}{2}$) 16920 lb. (2256 (8 Ton.

252)

240 Gal. reft.

Rule 149.] Take a 20th of the Grols Hundreds, (is here 9 Ton.) For every Ton deduct $1\frac{1}{3}$ Gallon; so 9 and $\frac{1}{3}$ of 9 is 12, and the Remainer is the Anfwer, as is proved above.

Now 18 *per Cent.* is $12\frac{1}{2}$ Gallon *per* Nett C. therefore what Hundreds are in Units place must be multiplied by $12\frac{1}{2}$; and for the Quarters of C. and Pounds, take a proportionable part of $12\frac{1}{2}$: from the Sum of all which take the $1\frac{1}{3}$ Gallon *per* Ton.

Another Example makes this plain; which I am minded to do, because it has not been before.

What Nett Tons and Gallons are in 189 C. 3 q. 21 lb. Grols? See the Operation.

And

C. 189 : 3 : 21

Ton. Gall.
9 : 112½ for the 189 C.
9⅜ for 3 qrs.
2⅓ for the 21 ℔. } Grofs.

9 : 124 Sum, Grofs.
12 = 9 & ⅓ of 9 deduct.

9 : 112 reft Nett Anfwer.

And for Proof of this Work by the longer way, do thus :

C. 189 : 3 : 21
℔ in a Nett C. 94 multiply.

756
1701

17766 ℔ in 189 C.
88 ℔ ad.

℔ 7½ *per*) 17854 Sum.
Gall.

And in 3 *qrs.* 21 *l.* or 105 *l.* grofs, there are Nett 88 *l.* thus

Gall. 112.94 :: 105.88.

252) 2380 (9 Ton
Anf.

and 112 ℔ reft, as in the fhorter way.

The Reafon of the fhort Rule.

There are two things that feem to fome as Difficultys in the fhorter Way, *viz.*

1. Why the Hundreds in Units place, the Quarters and Pounds, are caft up at the Rate of 12½ *per Cent.*

2. Why 1⅓ is deducted for every Ton.

As to the 1ft, you fee in the Margin that in a Nett Hundred there are 12½ Gallons, and fomewhat more. And

As to the 2d, you may obferve from the Work in the Example above, that the Units place of C. the Quarters and Pounds given, are work'd according to the Nett Meafure of 12½ Gall. *per* Nett C. But in taking a 20th of the Hundreds Grofs, (or half the Figures to the left hand the Units place of Hundreds) that half makes more than Nett Tons by 1⅓ Gallon in every Ton, as *per* Margin above; and that is the reafon you deduct 1⅓ in each Ton.

112 = the Grofs C.
deduct 18 *per* C. the Tare.

℔ 94 = the Nett C.
℔ 7½) (12 8/15 Gal. *per* C.
Multiply by = 20 = the Hund. in a Ton, and it gives 250⅔, which Taken from the Ton grofs 252, there

Remains ..... 1⅓ Gallon.

Note that Tret is an Allowance in Merchandize of *l.* 4 at 104 for the Duſt or Refuſe of the Commodity; and this is deducted out of the Suttle, (which is the Remainer when the Tare is deducted.)

SECT. V. *Concerning Gain and Loſs.*

THIS is a Rule whereby Merchants or other Traders know (when they have bought any Commodity by wholeſale) how they may retail the ſame out, to make any certain Gain by the whole Parcel, or at any Rate *per Cent.* &c.

Or when any Goods are damaged, they know hereby what they ſhall loſe *per Cent.* or by the whole, in ſelling the Pound, Ell, Yard, Ounce, *&c.* at any Rate leſs than it coſt.

I ſhall place this and the following Sections relating to the Buſineſs of Trade, *&c.* in that Order which I judge moſt proper for them to be learnt; not regarding what Method others have obſerved in treating thereof.

Caſe 1.] When a Merchant buyeth Goods for a certain Sum, to find how the ſame may be retail'd to gain a required Sum by the whole.

Examp. A Merchant buys ℔ 3780 Nett of Cotton-Wool, for 126*l.* what may he ſell the ſame for *per* ℔. to gain *l.* 15 : 15 : by the Sale?

Rule. Add *l.* 15 : 15 : — to the Coſt, and the Sum is *l.* 141 : 15 : —. Then ſay, If ℔ 3780 coſt me *l.* 141 : 15 : —, what will 1 ℔ coſt?

℔.	*l.*	*s.*	℔.
3780 :	141 :	15	:: 1

Divide the Pence in 141 *l.* 15 *s.* by 3780, and the Quotient is 9 *d.* which it muſt be ſold for *per* Pound, to gain *l.* 15 : 15 : in all.

Caſe 2.] Admit I bought 15 Bales of Linen at *l.* 17 : 15 : *per* Bale, how much muſt I ſell it for *per* Bale, to gain 10 *per Cent.* by the Sale?

Add { *l.* 266 : 5 : —
l. 26 : 12 : 6 } The Value of the Linen, and 10 *per Cent.* — *l.* 292 : 17 : 6

Bales 15 at 17 *l.* 15 *s.* each.

17

105
15

l. 255 at 17 *l.*
7 : 10 at 10.
3 : 15 at 5.

l. 266 : 5 Val. of the Bales.

You ſee, by Practice, the Value of the Bales is *l.* 266 : 5 : —

Then as 100 to 10 : : ſo *l.* 266 : 5 to *l.* 26 : 12 : 6; which is the Advance at 10 *per Cent.* which added as above, makes *l.* 292 : 17 : 6.

l.	*l.*	*l.*	*s.*	*l.*
100.	10 : :	266 :	5.	$26\frac{625}{1000}$

Bales.	*l.*	*s.*	*d.*	Bale.	*l.*	*s.*	*d.*
15.	292 :	17 :	6 : :	1.	19 :	10 :	6

Then

Then as 15 Bales to *l.* 292 : 17 : 6 : : ſo is 1 Bale to *l.* 19 : 10 : 6 ; which is the Anſwer : for 15 Bales at *l.* 19 : 10 : 6, is *l.* 292 : 17 : 6, the Coſt and Intereſt propoſed.

Caſe 3.] A Merchant bought Broad-Cloth at *l.* 20 *per* Piece ready Money, and ſold it again for *l.* 25 : 10 : — *per* Piece, to be paid at the end of ſix Months : What does he gain *per Cent.* in 12 Months ? Anſwer, *l.* 55 *per Cent.*

Firſt ſay, As 20 the Coſt to *l.* 5 : 10 : — the Gain : :
So is *l.* 100 to *l.* 27 : 10 : — the Gain in ſix Months.

Secondly ſay, As ſix Months to *l.* 27 : 10 : —
So is 12 Months to *l.* 55 the Gain *per Cent. per Ann.*

Caſe 4.] *In Caſe of Loſs* you muſt deduct inſtead of adding. Thus a Merchant bought 20 Bags, containing 6020 lb Nett of Cotton for *l.* 301 ; but being damaged by Sea, he is willing to loſe 10 *per Cent.* What muſt he ſell it for *per* Pound, to loſe that Sum ?

1ſt, You ſee by the firſt Proportion, that the Loſs by the whole will be *l.* 30 : 2 : — ; which deducted from the Coſt, there remains *l.* 270 : 18. therefore as 6020 lb. Cotton is to *l.* 270 : 18 : : ſo is 1 lb of Cotton to 10 *d.* $3\frac{43}{2115}$, the Anſwer.

l.	*l.*	*l.*	*l.* Loſs.
100.	10 : :	301.	30 : 2 : —

Deduct 30 : 2 : —

Remains *l.* 270 : 18 : —

			d.	*qr.*
lb 6020.	*l.* 270 : 18 : — : :	lb 1.	10 :	$3\frac{43}{2115}$

This is ſufficient to ſhew the Arithmetical Work of Loſs and Gain : How the Account thereof (or of Profit and Loſs) is kept in Books of Accounts, is ſhewn in my *Merchant's Magazine.* But this Book is not intended to be a Treatiſe of Merchandize, but to teach all kind of Arithmetic.

SECT. VI. *Fellowſhip.*

FEllowſhip is the Application of the Rule of Proportion, ſhewing what ſhare of Gain or Loſs every Merchant of thoſe who trade in company ſhall have, or bear in proportion to his ſhare of the general Stock ; and conſequently by this Rule alſo thoſe who have underwritten Policies know how to ſettle their Averages, in caſe part of what is inſured be loſt, proportionably to what each has ſubſcribed.

So

So that this may be called the Rule of Distribution, or (in case of Loss) of Contribution, (of the Profits obtained, or of Loss sustained.)

Quest. 1.] Two Men let to freight a Ship, wherein the first hath $\frac{9}{16}$, the other 7; and when the Voyage was performed, and all Charges deducted, the Nett Profits are found *l.* 480: What must each have?

Rule.] In this Case divide the whole Gain by the Number of Shares, and multiply the Quotient by each Man's particular Share, and the Products are the Answers, thus:

Or thus,

16. 480 :: 9. 270 } 2d way.
16. 480 :: 7. 210 }

480 Sum.

16) 480 (30 by 9 is = *l.* 270 = 1st.
by 7 is = *l.* 210 the 2d.
0
Proof *l.* 480 Sum.

Quest. 2.] Five Merchants trade in Company; *A.* put in 1173 *l.* B. 800, *C.* 977, *D.* 562, and *E.* 1000 *l.* and having each continued his Share first put in Stock till the Profits were computed and a Dividend made, they find they had gained by Trading 25312 *l.* What must each have?

This is best done by the Rule of Proportion, as you see: For as the whole Stock is to the whole Gain : : so is every one's Share in the Stock to his Share in the Gain.

The Sum of the Fractions is 4, as *per* Addition of Vulgar Fractions,

Sum or whole Stock.	*The whole Gain.*		*Each Man's Stock.*	*Each Man's Share of the Gain.*
4512.	25312	::	1173.	*A.* 6580 $\frac{2}{4}\frac{0}{5}\frac{1}{1}\frac{6}{2}$
4512.	25312	::	800.	*B.* 4487 $\frac{4}{4}\frac{2}{5}\frac{5}{1}\frac{6}{2}$
4512.	25312	::	977.	*C.* 5480 $\frac{4}{4}\frac{0}{5}\frac{6}{1}\frac{4}{2}$
4512.	25312	::	562.	*D.* 3152 $\frac{3}{4}\frac{5}{5}\frac{2}{1}\frac{0}{2}$
4512.	25312	::	1000.	*E.* 5609 $\frac{4}{4}\frac{1}{5}\frac{9}{1}\frac{2}{2}$

The Sum for Proof, 25312

Chap. 2. *Sect.* 2. *Head* 3. And the Aggregate of each Man's Profit makes the whole Gain; which proves the Truth of the Rule and Operations.

Quest. 3.] Three Men underwrite a Policy of Insurance, *viz.*

A. is contented with the Insurance to pay in case of Loss, *l.* 1000
B. is contented with the Insurance for — 750
C. for — 550
Sum *l.* 2300

Now it happen'd, that being closely pursued by Pirates, they were obliged to lighten the Ship, by throwing

throwing over-board Goods to the Value of *l.* 450; what muſt each Subſcriber bear of that Loſs, in proportion to what he has inſured?

The Proportion is as the whole Sum inſured is to the whole Loſs *l.* 450: ſo is the Sum each Inſurer ſubſcribed to his Proportion of the Loſs, as appears by the Operation in the Margin.

	l.	*l.* Loſs.	*l.*	
	2300.	459 ::	1000.	$195\frac{1}{2}\frac{5}{3}$ = *A*'s Loſs.
	2300.	459 ::	750.	$146\frac{1}{2}\frac{7}{3}$ = *B*'s Loſs.
	2300.	450 ::	550.	$107\frac{1}{2}\frac{4}{3}$ = *C*'s Loſs.

Sum for Proof, *l.* 450

Or if you would know what the Loſs is *per Cent.* to make the Average; this is only done by one ſingle direct Proportion thus, 2300. 450 :: 100. $19\frac{1}{2}\frac{3}{3}$, which is the Rate *per Cent.* to be paid, as is proved by multiplying the 100 *l.* that each inſured by the Rate *per Cent.* as in the Margin.

A's 10 Hund. multipl. by the Rate $19\frac{1}{2}\frac{3}{3}$ gives *l.* $195\frac{1}{1}\frac{5}{3}$
B's $7\frac{1}{2}$ Hund. by the Rate $19\frac{1}{2}\frac{3}{3}$ gives——— *l.* $146\frac{1}{2}\frac{7}{3}$
C's $4\frac{1}{2}$ by the Rate $19\frac{1}{2}\frac{3}{3}$ produceth——— *l.* $107\frac{1}{2}\frac{4}{3}$

Queſt. 4.] Three Men bought 120 Acres of Land for *l.* 2400; for which *A.* was to pay $\frac{1}{2}$, *B.* a 3d, and C. a 4th of the Charge, and were to have the like Proportion of the Land: how much muſt each pay, and have of the Land, according to the true Intent and Meaning of their Contract? For to think that $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, will make but one, is abſurd, becauſe a 3d is more than a 4th, and $\frac{1}{2}$ and $\frac{1}{4}$ makes 1. The Anſwer is found as follows.

$\frac{1}{2}$ of Acres 120 is 60; and of *l.* 2400 = 1200
$\frac{1}{3}$ is ..... 40; and ..... *l.* 800
$\frac{1}{4}$ is ..... 30; and ..... *l.* 600

Acres 130 Sums *l.* 2600

Too much by 10 and .... *l.* 200

Therefore I ſay, If 130 abate 10, and *l.* 2600 muſt abate *l.* 200; what muſt each abate, to anſwer the intended Contract? Thus;

Acr.	Acres.		*l.*		*l.*	
130.	10 :: 60.	$4\frac{8}{1}\frac{}{3}$	and if *l.* 2600.	200 ::	1200.	$92\frac{1}{2}\frac{1}{6}$ = *A*'s Ded.
130.	10 :: 40.	$3\frac{1}{1}\frac{}{3}$	*l.* 2600.	200 ::	800.	$61\frac{1}{2}\frac{4}{6}$ = *B*'s
130.	10 :: 30.	$2\frac{4}{1}\frac{}{3}$	*l.* 2600.	200 ::	600.	$46\frac{4}{2}\frac{}{6}$ = *C*'s

Acres 10 Sums *l.* 200

So

So that the Deductions of the respective Acres and Pounds being made (as *per* the Rules in Substraction of Fractions) from their apparent Shares, above,

The Answer is, { *A.* must have Acres $55\frac{5}{13}$, and pay *l.* $1107\frac{8}{26}$.
{ *B.* must have Acres $36\frac{12}{13}$, and pay *l.* $738\frac{12}{26}$.
{ *C.* must have Acres $27\frac{9}{13}$, and pay *l.* $553\frac{22}{26}$.

Acres 120 Sums *l.* 2400 Proof.

Or the Analogys (or Proportions) above, may be done from the Parts each is to have, by reducing the Fractions $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, into a common Denominator; as $\frac{6}{12}$, $\frac{4}{12}$, and $\frac{3}{12}$: For

As the Sum of the Numerators 13, is to 10, and to 200:
So is each Numerator 6, 4, and 3, to the Proportion that each is to deduct.

	Acres.	*l.*
Thus as 13. 10 :: 6.	$4\frac{8}{13}$	And as 13. 200 :: 6. $92\frac{4}{13}$.
13. 10 :: 4.	$3\frac{1}{13}$	And as 13. 200 :: 4. $61\frac{7}{13}$.
13. 10 :: 3.	$2\frac{4}{13}$	And as 13. 200 :: 3. $46\frac{2}{13}$.

When Time is considered in Partnership, You must multiply the Money in Stock by the Time it continued therein, and work with the Products as by the Rules above, and as in the Example following.

Quest. 5.] *A.* and *B.* trade in Partnership for one Year. *A.* put into Stock *l.* 200, and at 4 Months end he withdrew *l.* 40, and at 9 Months end put in *l.* 170. *B.* put in at first *l.* 150, and at 7 Months end *l.*200 more, and at the end of 10 Months he takes out *l.*160: they gain 700, what must each have of it?

A's *l.*200 : 4 Months is 800
*l.*160 : 5 Months = 800
*l.*330 : 3 Months = 990
} Sum of these Products } 2590

B's *l.*150 : 7 Months = 1050
350 : 3 Months = 1050
190 : 2 Months = 380
} Sum of these Products } 2480

Sum Total = 5070

Then 5070. 700 :: 2590. $357\frac{30}{70}$ = *A*'s Profit.
5070. 700 :: 2480. $342\frac{20}{70}$ *B*'s. Sum *l.*700 = the Proof.

Quest. 6.] A Ship's Company take a Prize worth 6000 *l.* Now the Captor having on board the following Officers, Midshipmen and

and Sailors, who are each to participate of the Prize-Money according to his Pay and Time entred on board; which was thus.

8 Officers entred on board 10 Mon. at 50 *s. per* Mo.
10 Midſhipmen ..... 9 Mon. at 35 *s. per* Mo.
150 Sailors ..... 8 Mon. at 25 *s. per* Mo.
} What muſt each have of the Prize?

Mon.

8 multip. by 10, and that Prod. by *l.*2 : 10, produceth *l.*200 :— :—
10 mult. by 9, and that .... by 1 : 15, gives .... 157 : 10 :—
150 .... by 8, and that .... by 1 : 5, is ..... 1500 :— :—

Sum ... 1857 : 10 :—

Then I ſay,

As $1857\frac{1}{2}$. 6000 :: 200. *l.* $646\frac{1}{3}\frac{1}{7}\frac{1}{1}\frac{0}{5}$ } To be divided equally among the Officers.
$1857\frac{1}{2}$. 6000 :: 157 : 10. $508\frac{2}{3}\frac{7}{7}\frac{8}{1}\frac{0}{5}$, Among the Midſhipm.
$1857\frac{1}{2}$. 6000 :: 1500. $4845\frac{8}{3}\frac{2}{7}\frac{5}{1}\frac{}{5}$, Among the Sailors.

Sum for Proof = *l.* 6000

SECT. VII. *Equation of Payments.*

BY this Rule or Part of the Application of Arithmetic, Men diſcover, when ſeveral Payments are due at different Times, how to fix upon one certain Time when the whole may be paid at once, without Loſs to the Debtor or Creditor.

The General and True Rule is,

As the Total of the Sums payable : is to a Unit (or 1 Month)
So is the Sum of the Products made of each Sum in its reſpective Time,
To the true Time when the whole ought to be paid.

There is a certain Gentleman, who makes ſome figure in theſe kind of Sciences, and he denies the Truth of this Rule; which I ſhall prove under my ſecond Queſtion to be juſt, notwithſtanding his Pretence of its being erroneous.

Queſt. 1. *A.* is indebted to *B. l.*100, to be paid at the end of three Months, alſo *l.*200 to be paid at the end of 4 Months, and *l.*300 to be paid at the end of 5 Months: Now to prevent the trouble of many Meetings, they agree to have but one Payment of the three Sums at one time; the Queſtion is, when that muſt be, without loſs to either *A.* or *B.*

According to the foregoing Rule,

l. 100 multiplied by 3 Months, produceth 300
200 ..... by 4 800
300 ..... by 5 1500
} Sum 2600 of the Products.

l. 600 Sum. *l.* *Mon.* *l.* *Mon.*

Then I ſay, 600. 1 :: 2600. $4\frac{1}{3}$

The Time ſought is $4\frac{1}{3}$ Months; at the end of which time, if the *l.* 600 be paid, neither Party will ſuſtain Loſs, as I ſhall prove by and by.

Queſt. 2.] *A.* oweth *B.* 5 Sums of Money to be paid at 5 Payments, *viz.*

l. 100 ready Money
200 at the end of $\frac{1}{2}$ a Month, or $\frac{1}{24}$ of a Year,
300 at 1 Month's end,
400 at 3 Months end,
500 at 6 Months end,
} At what time muſt the whole be paid without Loſs to *A.* or *B.*?
Anſw. $3\frac{1}{15}$ Months

l. 100 ready Money.
200 multiplied by $\frac{1}{2}$ a Month = *l.* 100
300 by 1 Month ——— = 300
400 by 3 Months ——— = 1200
500 by 6 Months ——— = 3000
1500 = Sum. 4600

Then as 1500. 1 :: 4600. $3\frac{1}{15}$ = the Anſwer.

Now that this is the true equated Time, will appear thus: For if the Intereſt of the reſpective Sums for their Times be equal to that of the whole for the equated Time, I think the Truth of the Anſwer can't be deny'd.

Now you'll find *l.* 100 ready Money Intereſt to be *l.* 0 : 0 : 0
Intereſt of *l.* 200 for $\frac{1}{2}$ a Month at 5 *per Cent.* is — : 8 : 4
300 for 1 Month is ——— 1 : 5 : —
400 for 3 Months is ——— 5 : — : —
500 for 6 Mon. (all at 5 *per Cent.*) is 12 : 10 : —
the Sum = 19 : 3 : 4

Note, The Inter. for Months I take from that of a Year proportionably.

And whoever will take the ſmall pains to examine, will find, That the Intereſt of *l.* 1500 for $3\frac{1}{15}$ Months is the very ſame Sum. But no wonder he denies it, who denies the common Way of computing

puting ſimple Intereſt, tho always practiſed by his Betters; and he may as well pretend that it ought to be computed by way of Compound Intereſt for every 2d in the Year, as object what he has advanced againſt the general Ways and Rules given by every body but himſelf, for working Queſtions both in Intereſt and Equation of Payments, which I have in the laſt Example ſufficiently proved to agree, tho I never did ſee the Truth of Equation proved this way before; which I hope will be a Satisfaction to the Ingenious, as will alſo the Novelty of the laſt Queſtion, *&c.*

And as a farther Proof to ſhew the Agreement of other Rules to the firſt, (or common one above) and that it is univerſally true for any Sum; I will find the equated Time under the firſt Queſtion, without taking notice of the Sums of Money, only the Parts of any Sum, and of the Time when payable. As,

Parts of any Sum.	*Payable at theſe Mon.*	*Products of theſe two.*	*Being Months.*	
$\frac{1}{6}$ at	3	$\frac{3}{6}$	$\frac{1}{2}$	} Theſe 3 add.
$\frac{1}{3}$ at	4	$\frac{4}{3}$	$1\frac{1}{3}$	
$\frac{1}{2}$ at	5	$\frac{5}{2}$	$2\frac{1}{6}$	

Sum = the equated Time above = $4\frac{1}{3}$ as before.

And thus might the Equation of Time be reduced into Tables.

Queſt. 3.] I lent my Friend *l.* 500 for 5 Months; for what time muſt he lend me *l.* 750, to recompence my Kindneſs to him? This is done as in the Margin. And for Proof of this,

l.	*Mon.*	*l.*
If 500.	5.	750
5		
75) 2500 ($3\frac{1}{3}$ Months for Anſwer.		
1		
25		

Intereſt at 5 *per Cent.* of *l.* 500 : 5 Months is *l.* 10 : 8 : 4
of *l.* 750 : $3\frac{1}{3}$ Months *l.* 10 : 8 : 4

SECT. VIII. *Barter.*

Barter or Commutation is a Rule among Traders, whereby they do, by conſidering the Price of their Goods, whether as for ready Money or advanced in Barter, ſo proportion the Rates and Quantities, as to know how much of one Specie may be exchanged for any quantity of another kind of Commodity. And all this is

diſcovered by that Golden Rule of Single Direct Proportion, as appears by the following Examples.

Queſt. 1.] *A.* hath 1752 Ells of Linnen at 2 *s.* 9 *d. per* Ell; *B.* has Cheeſe at 31 *s. per C.* How much Cheeſe muſt *B.* give *A.* for his Linnen? See the Operation.

In this Caſe it will be neceſſary to know the Value of *A*'s Linnen only in Shillings thus.

1ſt, 1752 } Mult.
2 }

3504 at 2 *s.*
$\frac{1}{4}$ that = 876 at 6 *d.*
$\frac{1}{2}$ that = 438 at 3 *d.*

Shill. = 4818 Sum.

2dly, Then ſay, If 31 *s.* buy 1 C. of Cheeſe, what will 4818 *s.* buy? Anſwer, $155\frac{13}{31}$.

s. *C.* *Cheeſe.* *s.*
31. 1 :: 4818 *C.*
31) ... (155 $\frac{13}{31}$
171
168
13

So that *B.* muſt give *A.* $155\frac{13}{31}$ *C.* of Cheeſe for his Linnen.

Queſt. 2.] *A.* has 52 Dozen of Hats (or 624) which he values at 2 *s.* 6 *d.* ready Money, but in Barter expects 2 *s.* 9 *d. per* Hat. *B.* has Cotton at 10 *d. per* Pound ready Money. How much Cotton muſt he give for the Hats, at a Price advanced in Barter proportionably to *A*'s Advance in Barter?

1ſt ſay, If *A*'s 2 *s.* 6 *d.* advance 3 *d*, what does *B*'s 10 *d.* advance?

d. *d.* *d.* *d.*
30. 3 :: 10. 1 = *B*'s Advance on a Pound of Cotton; ſo it is 11 *d. per* Pound in Barter.

2dly, The Value of 624 Hats at 2 *s.* 9 *d.* is *d.* 20592.

d. ℔ *Cotton.* *d.* ℔ *Cott.*

3dly ſay, If 11. 1 :: 20592. 1872 for Anſwer.

And for Proof of this, 624 Hats at 2 *s.* 9 *d.* each is *l.* 85 : 16 : —
And ſo is 1872 ℔ of Cotton at 11 *d. per* ℔ *l.* 85 : 16 : —

Queſt. 3.] Two Merchants have various kinds of Goods to barter: *A.* has *Indian* Silk 735 Yards at 8 *s.* 6 *d.* but in Barter will have 10 *s.*

Canes 532 at 3 *s.* but will in Barter have 3 *s.* 4 *d.*
Muſlin 16 Pieces at *l.* 4, but will have in Barter 4 *l.* 10 *s.*

B. has Scarlet Cloth at *l.* 1 *per* Yard,
Glaſs Manufacture at *l.* 0 : 1 : 8 *per* Pound, } Ready Money.
Ditto finer at ——— 2 : 4 *per* Pound, }

How

How many Yards of Cloth, and Pounds of each kind of Glaſs, (of each a like Number) muſt *B.* give *A.* advancing his Goods proportionably alſo in Barter? To anſwer this Queſtion,

1ſt, See what *A*'s Goods amount to at his bartering Price thus:

735 Yards at 10*s.* each, is *l.* 367 : 10 : —
532 Canes at 3*s.* 4*d.* .... *l.* 88 : 13 : 4 } Sum *l.* 528 : 3 : 4
Muſlin 16 Pieces at *l.* 4 : 10 : — *l.* 72 : — : —

2dly, The Difference between the Sums of *A*'s ready Money and bartering Price, is 11 *s.* 10 *d.* therefore what *B.* muſt advance in proportion is thus:

As the Sum of the Ready-Money Rate of one of each of *A*'s Goods, *l.* 4 : 11 : 6
Is to 11 *s.* 10 *d.* the Sum advanced upon one of each in Barter:
So is *B*'s *l.* 1 : 4 : — the Sum of one of each of his Goods,
To 3 *s.* 1 *d.* $\frac{270}{1098}$ *B*'s Advance in Barter; which muſt therefore be 27 *s.* 1 *d.* $\frac{270}{1098}$ for the Price of 1 of each of his Goods.

3dly ſay, If 27 *s.* 1 *d.* $\frac{270}{1098}$ buy 1 of each of *B*'s Commoditys, what will *l.* 528 : 3 : 4, the Value of *A*'s Goods, buy of each of *B*?

It will ſtand thus;

l.	*s.*		*l.*	*s.*	*d.*
27 : 1 $\frac{270}{1098}$		11 : :	528 : 3 : 4.		389 $\frac{262880}{357112}$

So that the Price of *A*'s Goods will buy 389 $\frac{262880}{357112}$ Yards of *B*'s Cloth, and as many Pounds of each ſort of his Glaſs.

And for Proof of this you'll find that 389 $\frac{262880}{357112}$ at 27 *s.* 1 $\frac{270}{1098}$ *d.* each, (being a Set of *B*'s Goods, or 1 of each) will amount to *l.* 528 : 3 : 4, the Value of *A*'s Goods, according to his advanced Price in Barter.

Or you may find the Price in Barter that *B.* ought to rate each ſort of his Goods: for,

	l.	*s.*	*d.*		*s.*	*d.*		*s.*	*d.*	
							B's *Advance in Barter.*			
As *A*'s	4 :	11 :	6.	11 :	10 : :	20.	to	2 :	$7\frac{42}{1098}$	on Cloth.
	4 :	11 :	6.	11 :	10 : :	1 : 8.	to	— :	$2\frac{644}{1098}$	on Glaſs.
	4 :	11 :	6.	11 :	10 : :	2 : 4.	to	— :	$3\frac{682}{1098}$	on ditto.

And by theſe particular Prices of *B*'s Goods, you may not only prove the Truth of the foregoing Operation, by ſeeing what

	s.	*d.*	
389 $\frac{262880}{357112}$ will amount to at	22 :	$7\frac{42}{1098}$ *per* Yard of Cloth,	Whoſe 3 Products added together, will make *l.* 528 : 3 : 4.
	1 :	$10\frac{644}{1098}$ *per* lb of Glaſs,	
	2 :	$7\frac{682}{1098}$ *per* lb ditto fine,	

But if you were not to deliver an equal Number of each, but according to any Proportion, you may now eaſily do the ſame.

And

And thus I have given the Reader a farther Account of the Usefulness and Extent of this Rule of Barter, *&c.* than has been done by any Author before, to make it agreeable to the other Parts of the Book foregoing; all which I doubt not but will be gratefully accepted by the Ingenuous Reader.

Sect. IX. *Exchange.*

As the former or last Section exhibits Rules for the Bartering of one Commodity for another; so this shews how to exchange Money for Money, or, in the way of Negotiation, Money for Bills, *&c.* And therefore this is the proper place where Rules for Exchange ought to be inserted, as being another kind of Barter.

I shall not here trouble the Reader with an unnecessary and uncertain Account of the Value of foreign Coin of all Countrys, (about which most differ) because they who have Money to remit, must be governed by the Course of Exchange, and it is notorious that does rise and fall according as foreign Trade is influenced by several Circumstances relating to this or that Country; only I shall give the Weight and Value of the four several sorts of Pieces of Eight, because they are current in most places.

	Weight. *dw. gr.*	*True Value.* *s. d.*
The Piece of 8 *Pillar*	17 : 12	4 : 6¼
Piece of 8 *Sevil*	17 : 12	4 : 6
Piece of 8 *Mexico*	17 : 12	4 : 6
Piece of 8 *Peru*	17 : 12	4 : 5

And for the other Denomination of foreign Coin at Places which have Exchange with *England*, they are,

1. The Pound *Flemish* 33 *s.* 4 *d.* in Value 1 Pound *Sterling*; in which Denomination *London* exchanges with *Amsterdam*, *Rotterdam*, *Antwerp*, and *Hamborough*.

2. In Pieces of 8 *Mexico* for *English* Pence, *London* exchanges with *Madrid*, *Cadiz*, *Genoa*, *Leghorn*.

3. For Ducats (one being in real Value 4 *s.* 4 *d.*¼ *Sterling*) *London* exchanges with *Venice*.

4. For the *French* Crown (in Value 4 *s.* 6 *d.* *Sterling*) *London* exchanges with *Paris*.

5. For the Mill-rea of 6 *s.* 8 *d.*½ *Sterling*, *London* exchanges with *Oporto* in *Spain*, and *Lisbon* in *Portugal*.

But

But the *Courſe of Exchange* is ſometimts higher and lower than the Rates above, which are called *the Par of Exchange.*

6. I ſhall next ſhew the Nature of Exchanging by Bill; and 2dly, how to caſt up Bills.

The firſt I cannot do more effectually than by giving the Form of a Foreign Bill, and that is thus:

Rotterdam, *April* 10. 1716. for *l.*1272 : 13 : 4 *Flemiſh* at 33 *s.* 4 *d. per* Pound *Sterl.*

AT Uſance pay this my firſt of Exchange unto Mr. Edward Jones, *or his Order, Twelve Hundred Seventy-two Pounds Thirteen Shillings and Four Pence* Flemiſh; *Exchange at Thirty-three Shillings and Four Pence* per *Pound* Sterl. *for the Value received of Mr.* John Hall, *and account it to*

To Meſſieurs Andrea *and* Jean Varelſt, *Merchants in* London.

Your Humble Servant, Herman Vanderſtagen.

Hence 'tis plain, that *Hall* pays the Money in *Holland*, (and is called the Remitter) to *Vanderſtagen* (who is the Drawer) drawing his Bill on the *Varelſts* (his Correſpondents at *London*) to pay the Value to *Jones* at *London*, who is *Hall*'s Correſpondent.

And thus there are, you ſee, four Perſons concerned in a Bill of Exchange, *viz.* the Remitter, the Drawer, he that pays the Bill, and he to whom it is paid. *Note, Uſance is the Time between any Day of one Month to the ſame Day of the next.*

7. The next thing is to ſhew how this Bill, *&c.* is converted into Pounds, *&c.* *Sterling* Money, which is the principal thing intended by the Rule of Exchange as 'tis here placed; *i. e.* to ſhew how to reduce one Country's Coin to another.

	l.	*s.*	*d.*
Flemiſh	1272	13	4

20

s.	*d.*	
33	4	25453
12		12
Ben. *Flem.* 400		305440 (763 *l.*
1		... 1
		25
		14
		240 reſts *l.*
		20 *s.* mult.
400)		4800 (12 *s.*
1		1
		0

A ſhorter Way thus:

*l.*1272 : 13 : 4 *Flem.*
3 mult.

Divide by 5) 3818 : 00 : 0
Anſwer = *l.* 763 : 12 : — *Sterl.*

So that in *l.* 1272 : 13 : 4 *Flemiſh* there are *l.* 763 : 12 : — *Sterling*. And thus *Dutch* Money may be reduced to *Engliſh* at any Rate *per* Pound *Sterling*; but in the above, of 33 *s.* 4 *d. Flemiſh per* Pound, the Work is performed much ſhorter, as above toward the right-hand Margin.

8. And if a Bill is drawn from *Lisbon* of Mill-rea's 1432 at 6 *s.* 10 *d.* $\frac{5}{8}$ *Sterling per* Mili-rea; how much *Engliſh* Money is that Bill?

Mill-rea.	*s. d.*	*Mill-reas.*
1.	6 : $10\frac{5}{8}$ :: 1432	1432 at 6 *s.* 10 *d.* $\frac{5}{8}$

By Practice, $\frac{1}{3}$ = 477 : 6 : 8
and $\frac{1}{10}$ = 11 : 18 : 8
And 1432 multip. by 5, and divided by 8 = 3 : 14 : 7

Anſwer, *Sterling* = *l.* 492 : 19 : 11

9. Now ſuppoſe the *Dutch* Bill above be endorſed and ſent to *Leghorn*, at 56 *d. Sterling per* Piece of 8; and if it be again endorſed at *Leghorn*, and remitted to *Amſterdam*, the Exchange at $93\frac{1}{3}$ Pence *Flemiſh per* Piece of 8: how many Pieces of 8 muſt be paid for the Bill at *Leghorn*, and how many Pounds *Flemiſh* at *Amſterdam*, according to this Courſe of Exchange?

1ſt, In *l.* 763 : 12 in the Bill, there are 183264 Pence *Sterling*; which divided by 56, gives $3272\frac{4}{7}$ Pieces of 8.

2dly, $3272\frac{4}{7}$ being multiplied by $93\frac{1}{3}$ Pence *Flemiſh* for each Piece of 8, or $^{2}2^{9}0^{8}/_{7}$ by $^{2}8^{0}/_{3}$ produceth $^{6}4^{1}4^{2}4^{0}/_{2}{}_{1}$ Pence *Flemiſh*; and being divided by 12, and then by 20, gives Pounds *Flemiſh l.* 1272 : 13 : 4 as above, which proves the Truth of the whole Work.

10. But theſe Queſtions will be ſo eaſy to thoſe who have proceeded gradually to learn thus far, that I need not enlarge much farther on this Rule of Exchange; what has been obſerved being ſufficient to ſhew how either the Coins, or Weights and Meaſures of one Country, are reduced to thoſe of any other.

For in 32755 *Flemiſh* Ells there are 19653 *Engliſh*; for a *Flemiſh* Ell is $\frac{3}{5}$ of an *Engliſh*, or $\frac{6}{10}$ rather, becauſe it ſaves the Work of Diviſion.

32755	
6	
196530	
1	

11. A *Dutchman* ſells 29380 *Flemiſh* Ells of *Holland* Duck to an *Engliſhman*, a *Spaniard*, an *Italian*, and a *Portugueſe*, who are to have each a like quantity in their own Country Meaſure; how much muſt each have therein?

The

The *Dutch* in *Engliſh* Ells are 17628, and
17628 Ells divided by 4, gives 4407 Ells *Engliſh* each, and

Ells.	*Anſwer.*
4407 is for the *Briton*	4407 Ells.
4407 for the *Spaniard* at $\frac{7}{10}$ Canes *per* Ell *Engliſh*	3084$\frac{9}{10}$ Canes.
4407 for the *Italian* at 2 Braces *per* Ell *Engliſh*	8814 Braces.
4407 for the *Portugueſe* at 1 Vare *per* Ell is	4407 Vares.

This may be proved ſeveral ways, which I leave to the Reader's Judgment.

SECT. X. *Alligation.*

ALLIGATION may be called *The Rule of Mixture*, or of *compounding Ingredients*, becauſe it teaches how to mix ſeveral Species of Simples according to any Intent or Deſign propoſed. It is either Medial or Alternate.

Alligation Medial ſhews what the mean Price of a Pound, Ounce, *&c.* is worth, when ſeveral Quantitys of ſeveral Values are mix'd together, *&c.* as *per* the Caſes following.

Alligation Alternate ſhews how much of various kinds of Simples may be taken to make up any aſſigned Quantity of a Compound, which ſhall be worth a Price propoſed.

Of Medial Alligation.

Caſe 1.] A Goldſmith hath Gold 12 $\frac{z}{3}$ at 4 *l. per* $\frac{z}{3}$; 8 $\frac{z}{3}$ at *l.* 4:5 ; 3 $\frac{z}{3}$ at *l.* 4:6:8; and 9 $\frac{z}{3}$ at *l.* 4:13:4 *per* Ounce: what is an Ounce worth, ſuppoſe theſe be all melted down together? Anſwer, *l.* 4:7:5$\frac{1}{2}$.

Rule.] Multiply each Quantity given by the Price; then by direct Proportion,

As the Sum of the Quantities given
Is to the Sum of the ſaid Products;
So is one Ounce of the Mixture
To its Value. *See the Work following.*

Ounces Gold.	*The Price of* 1 $\frac{z}{3}$.
12 multiplied by *l.* 4 : —	the Product is *l.* 48.
8 ..... by 4:5	produceth —— 34.
3 ..... by 4:6:8	produceth —— 13.
9 ..... by 4:13:4	produceth —— 42.
32 Sum.	137 Sum.

$\frac{2}{3}$. *l.* $\frac{2}{3}$ *l.*

Then fay, 32. 137 :: 1. $4\frac{9}{32}$, or (to *l.* 4 : 5 : $7\frac{2}{1}$.

And by the ſame Rule the Value of any other Quantity of that Compoſition is found: as ſuppoſe 7 in the laſt Example is worth $29\frac{3}{5}\frac{1}{2}$, for as $\frac{2}{3}$. *l.* $\frac{2}{3}$. *l.*

32. 137 :: 7. $29\frac{3}{5}\frac{1}{2}$.

Caſe 2.] To increaſe or diminiſh a Compound proportionably, by knowing the ſeveral Quantitys of the Simples in the Compoſition.

Rule. As the Sum of the particular Quantitys of the Compound given

Is to the whole Quantity propoſed to be augmented or leſſened:

So is each particular Quantity in the given Compound

To the due Proportion required of that Specie, Fineneſs, *&c.*

Example. I would augment the Compound in the laſt Caſe to $48\frac{2}{3}$, that is, I would add 16 to the 32; how much muſt I take of each ſimple Ingredient? See the Operation.

		Anſwer.
12	Then as 32. 16 :: 12.	$\frac{2}{3}$ 6
8	32. 16 :: 8.	4
3	32. 16 :: 3.	$1\frac{1}{2}$
9	32. 16 :: 9.	$4\frac{1}{2}$
Sum = 32		Sum = 16 Proof to add.

So that I muſt have $18\frac{2}{3}$ of *l.* 4 *per* $\frac{2}{3}$.

$12\frac{2}{3}$ of *l.* 4 : 5 : —

$4\frac{1}{2}$ of *l.* 4 : 6 : 8, and

$13\frac{1}{2}$ of *l.* 4 : 13 : 4.

48 Sum for Proof, in the whole.

Caſe 3.] Having the Simples of any Compound given, to find how much of each kind of ſimple Ingredient is in any part of that Compoſition.

Rule. As the Total of the Compoſition

Is to the Quantity of any Simple in that Compoſition:

So is the Total Quantity propoſed to be proportionably compounded,

To the Quantity of each Simple to be in that propoſed Quantity.

Example.

Example. I would know how much of each Ingredient (or Price of Gold mention'd in the firſt Caſe) is in a Pound or 12 ℥ of the 32, being the Compound given? See the Operation in the Margin.

Anſwer.

32. 12 :: 12. ℥ 4½ of *l.* 4 *per* ℥.
32. 12 :: 8. ℥ of 4 : 5 : —
32. 12 :: 3. 1⅛ of 4 : 6 : 8
32. 12 :: 9. 3⅜ of 4 : 13 : 4

℥ 12 Sum Proof.

Caſe 4.] The Total of the Compound of two Simples, with the Total Value of that Compoſition, and the Value of a Unit of each Simple being given; to find the Quantity of each ſimple Ingredient in the Compoſition.

Rule. Multiply the Total Quantity of the Compoſition, (here 20) by the leſſer Price of the Unit (here 4) then deduct the Product from the Total Value of the Compoſition (here 82) and divide the Remainer by the Difference in Value of a Unit of the two Simples given (as here 5 *s.* or ¼ of a Pound) and the Quotient is the Quantity of the higher-prized Simple (here 8) whoſe Complement to 20 is 12: ſo that the Anſwer is 12 ℥ of *l.* 4 *per* Ounce, and 8 ℥ of *l.* 4 : 5 *per* Ounce. This Canon I diſcover'd by Algebra, as appears in the Solution of Queſtions by various Poſitions.

Gold at *l.* 4 *per* ℥.
Ditto at *l.* 4 :

Total of the Compoſition } = 20 ℥. Total Value *l.* 82

4 — 80

80 — *l.* ¼) 2 (8

Caſe 5.] To find the Quantities of each ſimple Ingredient (when thoſe Simples are more than 2 in Number) contained in a Compoſition, by having the Totals of the Quantity compounded, and of the Value; and alſo the Value of a Unit of each ſimple Ingredient given, as

℥	of Gold at	*l.* 4 *per* ℥	=
℥	ditto at	*l.* 4 ¼	=
℥	ditto at	*l.* 4 ⅓	=
℥	ditto at	*l.* 4 ⅖	=

Total of the Compoſition = 32 ℥. Total Value *l.* 137

Rule. To theſe kind of Queſtions, as in thoſe of Alligation Alternate, various Anſwers may be given, and yet all true. You may

beſt do them by 2 at a time, as in the laſt Caſe. I ſuppoſe the 2 firſt 15 of the total Mixture, and 63 of the total Value, and ſo I find 3 at *l.* 4, and 12 at $4\frac{1}{4}$. Then the reſt of the total Compound is 17, and of the Value 74; which, according to the 2 latter Prices, gives 16 at $4\frac{1}{3}$, and 1 at $4\frac{2}{3}$.

But *note*, That you muſt ſo diſcreetly divide the total Quantity, and value that when the Product of the 1ſt in 1 of the 2 Prices is taken from the latter, the Remainer may not be ſo much as (when divided by the Difference of the Prices) will give a Quotient ſo great as that part of the total Quantity of the Ingredient which you fix'd upon, or ſuppoſed. See the Operation above.

1ſt 2 = 15	and = 63
4	leſs . . . 60 deduct.
Product = 60	$\frac{1}{4}$) 3 (12 at $4\frac{3}{4}$.

2dly 15	63 deduct.
$4\frac{3}{4}$	$63\frac{3}{4}$
Product = $63\frac{3}{4}$	$\frac{1}{4}$) $\frac{3}{4}$ ($\frac{12}{4}$ = 3 at 4.

the 2d 2 = 17	and 74
$4\frac{1}{3}$	$73\frac{2}{3}$ deduct.
Product = $73\frac{2}{3}$	$\frac{1}{3}$) $\frac{2}{3}$ (1 at $4\frac{2}{3}$.

laſtly 17	74 deduct.
$4\frac{2}{3}$	$79\frac{1}{3}$
$79\frac{1}{3}$	$\frac{1}{3}$) $5\frac{2}{3}$ ($\frac{48}{3}$ or 16 at $4\frac{3}{3}$.

II. *Alligation Alternate.*

Queſt. 1. A Farmer hath 4 ſorts of Wheat, *viz.* 5 *s.* 6 *s.* 7 *s.* and 7 *s.* 6 *d. per* Buſhel; and he is minded to mix ſo much of each ſort, as will make 64 Buſhels worth 6 *s.* 6 *d. per* Buſhel: how much of each ſort muſt he take?

Having placed the Prices as you ſee, and the mean Price; take the Difference between the mean Price 6 *s.* 6 *d.* and 5 *s.* (the 1ſt Price) which is 1 *s.* 6 *d.* this you muſt put down (in the 1ſt Way) againſt 7 *s.* 6 *d.* (becauſe bigger than the mean

	Prices.	*Differences.*	
	s.	*s.* *d.*	
	5	1 : 0	
s. *d.*	6	0 : 6	the 1ſt Way.
The mean Price 6 : 6			
	7	0 : 6	
	7 : 6	1 : 6	
		3 : 6 = Sum.	

mean Price.) Then go on, and put the Difference between 6 *s.* 6 *d.* the mean Price, and 6 *s.* (the 2d Price) which is 6 *d.* againſt the Price (7 *s.*) becauſe bigger than the mean Price. Then put

A Second Way.

		s.	*s. d.*
		5	0 : 6
s.	*d.*	6	1 : 0
6 : 6			
		7	1 : 6
		7 : 6	0 : 6

Sum = 3 : 6

Third Way.

		s.	*s. d.*	*Sums. s. d.*
		5	0 : 6 ; 1 *s.*	1 : 6
s.	*d.*	6	0 : 6 ; 1	1 : 6
6 : 6				
		7	1 : 6 ; 6 *d.*	2 : 0
		7 : 6	1 : 6 ; 6 *d.*	2 : 0

Sum Total = 7 : 0

the Difference between 6 *s.* 6 *d.* and 7 *s.* (the 3d Price) againſt 6 *s.* becauſe that is leſs than the mean Price. Laſtly, the Difference between 6 *s.* 6 *d.* and 7 *s.* 6 *d.* is 1 *s.* which put againſt 5, the firſt Price. And thus having put the Differences between the mean Price and thoſe leſs than it againſt the Prices bigger than the mean Price; and the Differences between the mean Price and thoſe greater than it, right againſt thoſe that are leſſer alternately;

2dly, Sum up the Differences, which you ſee is 3 *s.* 6 *d.*

3dly, Say by the ſingle Rule of Proportion Direct,

The Sum of the Differences.		*Buſhels the whole Mixture.*	*The Differences.*	*Buſhels required.*
s.	*d.*		*d.*	
As 3 :	6.	64 : :	12.	$18\frac{1}{4}\frac{2}{2}$ of that of 5 *s. per* Buſhel.
3 :	6.	64 : :	6.	$9\frac{6}{4}\frac{}{2}$ of that of 6 *s. per* Buſhel.
3 :	6.	64 : :	6.	$9\frac{6}{4}\frac{}{2}$ of that of 7 *s. per* Buſhel.
3 :	6.	64 : :	18.	$27\frac{1}{4}\frac{8}{2}$ of that of 7 *s.* 6 *d. per* Buſh.

Sum (or Proof) 64 being the whole Mixture.

The Proportions by the ſecond Way of placing the Differences are thus:

s.	*d.*		*d.*	
3 :	6.	64 : :	6.	$9\frac{6}{4}\frac{}{2}$ Buſhels of 5 *s. per* Buſhel.
3 :	6.	64 : :	12.	$18\frac{1}{4}\frac{2}{2}$ Buſhels of 6 *s.*
3 :	6.	64 : :	18.	$27\frac{1}{4}\frac{8}{2}$ Buſhels of 7 *s.*
3 :	6.	64 : :	6.	$9\frac{6}{4}\frac{}{2}$ Buſhels of 7 *s.* 6 *d.*

64 Sum for Proof.

And

And the Proportions by the third Way of placing the Differences are ſtill various. Thus,

	s.	d.		d.	
As 7 or	84.	64 ::	18.	$13\frac{5\,0}{8\,4}$	Buſhels at 5 *s. per* Buſhel.
	84.	64 ::	18.	$13\frac{6\,0}{8\,4}$	Buſhels at 6 *s.*
	84.	64 ::	24	$18\frac{2\,4}{8\,4}$	Buſhels at 7 *s.*
	84.	64 ::	24	$18\frac{2\,4}{8\,4}$	Buſhels at 7 *s.* 6 *d.*

64 Sum as before.

In the 2d Way you ſee that the Difference between the mean Price and 5 *s.* is placed againſt the Price 7 *s.* and 6 *s.* againſt 7 *s.* 6 *d.* 7 *s.* againſt 5 *s.* and between the 6 *s.* 6 *d.* and 7 *s.* 6 *d.* againſt 6 *s.*

And in the 3d Variety,

The Difference between—	s. d.	s.	is placed againſt the Prices—	s.	s.	d.
	6 : 6 &	5		7	& 7	: 6
		6		7	& 7	: 6
		7		5	& 6	
		7 : 6		5	& 6	

So that the Difference between the mean Price and thoſe leſs than it are placed againſt all thoſe greater than it; and the Difference between the mean Price and thoſe greater are placed againſt all thoſe that are leſſer than it. Then the Sum of the Differences in each Line are added together in the Column next the right hand; as 6 *d.* and 1 *s.* in the middle Column is 1 *s.* 6 *d.* in the third Column; and 1 *s.* 6 *d.* and 6 *d.* is 2 *s.* So the Sum of that third Column is 7 *s.* and thus ariſeth the Numbers in proportion, in the third Way or Variety.

Hence you ſee, that there are three different Anſwers to one Queſtion, and yet they are all true, as fully giving what is required in the Demand; whence (as well as from placing the Differences in each) it may juſtly be called *Alternate* Alligation. And for a thorow and intire Proof of this, I ſhall ſhew that 64 Buſhels at the mean Price 6 *s.* 6 *d. per* Buſhel, is (in the laſt or moſt abſtruſe, tho beſt Way of the three Varietys) the ſame Amount as each of the Quantitys exhibited for Anſwers, being caſt up at the Prices given, and added together, amount to. Thus,

64 Buſhels

64 Bushels } the whole to be mix'd at the mean Price 6 *s.* 6 *d.* amounts to —— { *l.* 20 : 16 : 0

So also $13\frac{6}{8}\frac{0}{4}$ Bush. of 5 *s. per* Bush. comes to *l.* 3 : $8\frac{4}{8}\frac{8}{4}$

The Clear Proof of the Operation.

$13\frac{6}{8}\frac{0}{4}$ ..... of 6 *s.* ..... *l.* 4 : $2\frac{2}{8}\frac{4}{4}$

$18\frac{2}{8}\frac{4}{4}$ ..... of 7 *s.* ..... *l.* 6 : 8

$18\frac{2}{8}\frac{4}{4}$ ..... of 7 *s.* 6 *d.* ..... *l.* 6 : $17\frac{1}{8}\frac{2}{4}$

64 Sum of the Sorts. Sum = *l.* 20 : 16 = Tot. Value, *ut supra.*

I shall give one other Example, where there is only one Price lesser than the mean Price; and this I shall do according to the Method of the third Variety foregoing, that being the best, as making the equallest Mixture: where it is required to know how much of 2, 5, 9, and 17 must be taken to make 100 of, or worth 4. See the Operation in the Margin.

Prices given.	*Differences of the Prices and the mean Price.*	= *Sum of each Line of Differ.*
2 *s.* ——	1, 5, 13,	= 19
4 ——		
= the mean Price. 5 ——	2	= 2
9 ——	2	= 2
17 ——	2	= 2
	Sum of all the Differences	25

And this is proved as before, thus:

76 at 2 = 152
8 at 5 = 40
8 at 9 = 72
8 at 17 = 136

Sum = 400 = 100 at 4.

Answer.

Now 25. 100 :: 19. 76 at 2 *s.*
25. 100 :: 2. 8 at 5
25. 100 :: 2. 8 at 9
25. 100 :: 2. 8 at 17

Note, That if the Prices given were even so many, the Method is the same.

SECT.

SECT. XI. *The Rule of False.*

THIS is so called not because it requires any more Conjuration, or is more difficult to comprehend or perform than some of the Rules preceding; but it's properly called *The Rule of False Supposition*, because by supposing Numbers to be the Answers to Questions which are not really so, but are feigned or supposed at pleasure, we do by such false or fictitious ones discover the true Numbers required.

An Example or two will illustrate this, and I shall not insist farther, because the Solution of an easy simple Equation in Algebra answers not only any Question in this Rule, but also gives at the same time a Canon whereby any Question of the like kind is much more easily and speedily resolved.

Quest. 1.] Three Merchants built a Ship, which cost *l.* 1600 *A.* paid a Sum not known, *B.* paid double to *A.* within *l.* 50, *C.* paid as much as *A.* and *B.* wanting *l.* 100: What did each pay of the Cost?

	Operation Column. *l.*	*Suppositions.*	*Errors.*
1st, Suppose *A.* paid	200	200	
Then, according to the Question, *B.* paid	350		
And *C.* paid	450		
Sum	1000		
But it should have been *l.* 1600, therefore the Error is		.....	600
2d, Suppose *A.* paid	250	250	
Then it follows that *B.* paid	450		
And *C.* paid, (according to the Question)	600		
Sum	1300		
Which is therefore still too little by		.....	300
Then multiplying the 1st Position by the 2d Error, gives	60000		
And the 2d Suppos. in the 1st Error, gives	150000		
The Difference of the Product is	= 90000		
Which divided by the Differ. of the Errors (300)			
The Answer is, that *A.* put in	300		
Then *B.* put in	550		
And *C.*	750		
Sum for Proof	1600		

Here

Here you see, that the Suppositions and Errors being multiplied, you divide the Difference of the Products by the Difference of the Errors, which you must always do when the Errors are both Surplusages, or both Deficiencys of the supposed Numbers.

But if the one Error is caused by supposing too much, the other by supposing too little; then you must divide the Sum of the said Products by the Sum of the Errors, and the Quotient is the Answer, as in the next Example appears: which Rule you may retain in mind by this Distich;

When Errors are not both of the same kind,
To add the Products, as the Errors, mind:
But if they're both too small, or both too much,
Substraction must be us'd, in Cases such.

Quest. 2.] Admit a Church hath a Choir (or Chancel) 40 foot long; and that the Ground taken up by the Belfrey is $\frac{1}{4}$ of the Chancel, and $\frac{1}{6}$ of the Nave, or Body; the Nave (or Body of the Church) is 3 times the Length of the Belfrey, and $\frac{3}{4}$ the Chancel: how long is the whole Church within the Walls, and every Part of it?

First find the Length of the Nave or main Body of the Church, for then the rest are discovered, thus:

The Operation.	*Suppositions.*	*Errors.*
1. Suppose the Nave be	150	
$\frac{1}{6}$ of that is ——— 25		
$\frac{1}{4}$ of the Chancel ——— 10		
Sum, is the Belfrey 35		
Then the Nave (according to the Question) is 3 times that ——— 105		
And $\frac{3}{4}$ of the Chancel, *viz.* ——— 30		
Sum is but 135		
Which being less than 150 supposed, the Error is ..	....	15
2. Suppose the Nave be	102	
$\frac{1}{6}$ of that is ——— 17		
$\frac{1}{4}$ of the Chancel is ——— 10		
The Sum or Belfrey is 27		
3 times that Belfrey is ——— 81		
$\frac{3}{4}$ of the Chancel is ——— 30		
Sum is 111		
Which being more than the 102 supposed, the Error is	....	9

Now the Product of 150 by 9 is ——— 1350
And of the 102 by the Error 15, gives 1530.

Which 2 Products I am to add according to the Rule, because the 1st Error was the effect of supposing too much, the 2d of supposing too little; and the Sum is ——— 2880

That divided by the Sum of the Errors = 24 } = 120
gives the Length of the Nave of the Church }
And the Chancel being = 40
And the Belfrey $\frac{1}{6}$ of 120 and $\frac{1}{4}$ of 40 is = 30

The Length of the whole Church is = 190

And you'll find these 3 Dimensions (120, 40, and 30) to answer in all respects what is proposed in the Question, which is a Proof of the Work.

And thus you have a clear and perspicuous Method of solving Questions in this Rule of False Position; which may suffice till we come to Algebra, where the Reader will find a great Variety of Problems answered the best and shortest way, consistent with demonstrative Plainness.

The Canon for answering Questions of like nature with the 1st, is this: Divide the whole Value of the Ship, more twice what *B.* abateth of paying double to *A.* more what *C.* abateth of paying as much as *A.* and *B.* by 6, and the Quotient is what *A.* paid. And this Canon holds, vary the Numbers as you please, keeping to the Words.

The Canon answering Questions of like nature with the 2d, is, Whatsoever Length the Chancel of the Church is, if that be multiplied by 3, it gives the Length of the Body of the Church proportioned as in the Question, as 3 times 40 is 120. But if you suppose the Chancel 60, then is the Nave 180, and the Belfrey 45, in all 285. For Proof $\frac{1}{6}$ of the Nave, and $\frac{1}{4}$ of the Chancel 60, is 45 = the Belfrey; and 3 times that (or 135) added to $\frac{3}{4}$ of the Chancel, is 180.

Single Position.

But there are some Questions answer'd by one single Supposition, with the help of the Rule of Proportion. As for

Exam-

Example.] Three Men build an Houſe, which coſt *l.* 300. *A.* paid a Sum unknown, *B.* paid twice as much, and *C.* paid 3 times ſo much; what did each pay of the *l.* 300?

I ſuppoſe *A. l.* 40, then *B.* muſt pay 80, and *C.* = 120; the Sum of which is but *l.* 240, inſtead of *l.* 300. Then I ſay,

If 240 doth ariſe from ſuppoſing 40,
What Number will 300 be the Reſult of?
The Anſwer is 50; for

240. 40 :: 300. 50

Now that 50 is the Sum that *A.* paid, may be proved thus:

A. = 50
B. paid = 100 } Sum = 300 for Proof.
C. paid = 150

Here ends Vulgar Arithmetic.

CHAP. III.

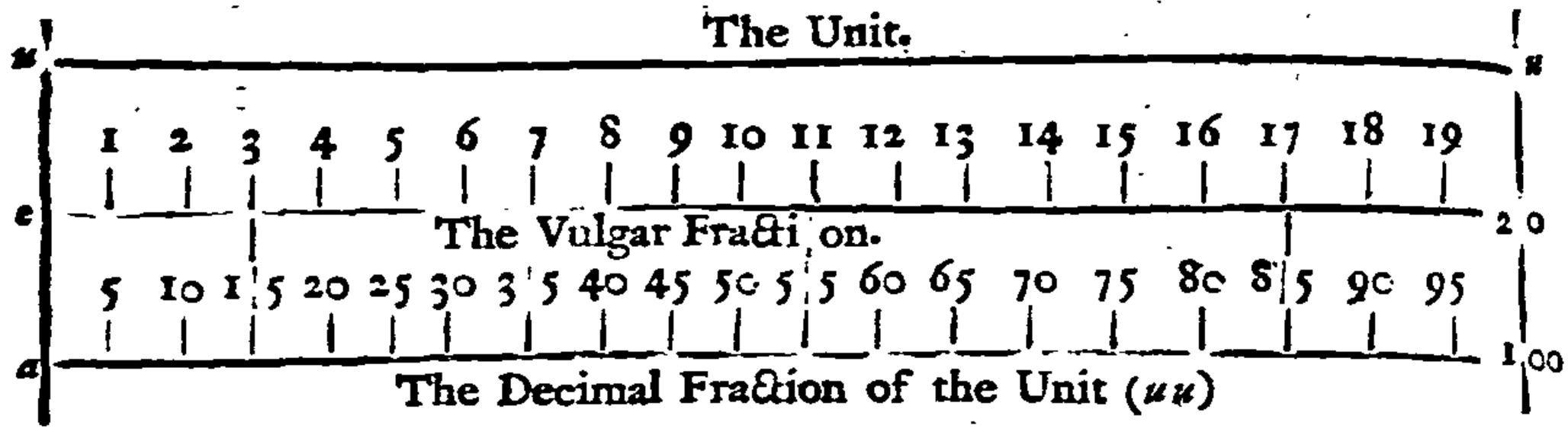
Decimal Arithmetic.

SECT. I. *Notation and Numeration.*

THIS kind of Arithmetic takes its Name from the Nature of the Denominator, which is always 10, or ſome Power of 10; in which only it differs from a Vulgar Fraction: for as that has any promiſcuous Number for its Denominator, ſo a Decimal Fraction hath always 10, 100, 1000, 10000, *&c.* for its Denominator.

2. Hence 'tis eaſy (the Denominators of Decimals being ſo few in compariſon of Vulgar, and ſo certain) to expreſs a Decimal Fraction without its Denominator, by ſeparating ſo many places of the Numerator, as the Denominator hath of Cyphers, by a Point: Thus $\frac{5}{10}$ is wrote .5; $\frac{25}{100}$ is .25; $\frac{75}{1000}$ is .075, *&c.* And if (as in the laſt) there be not ſo many places in the Numerator as there are Cyphers in its Denominator, you muſt make up that Number by placing a Cypher or Cyphers towards the left hand of the Numerator.

3. The Nature of a Decimal Fraction will farther appear by what follows:



The uppermoſt Line (*u u*) is a Unit; the Line (*e* 20) is of Vulgar Fractions of that Unit, whoſe common Denominator is 20; and the Line (*a*, 100) is of Decimal Fractions of the Line (*u u*) whoſe Denominator is 100.

And here the Decimal Fraction $\frac{15}{100}$ or .15 is equal to the Vulgar Fraction $\frac{3}{20}$; .35 is equal to $\frac{7}{20}$; .85 equal to $\frac{17}{20}$, *&c.*

4. But that you may be the better able to read or write down any Decimal Fraction properly, take the following Table; the Words at the head of which ſhew how to read the Numerator, and thoſe toward the right hand, to read the Denominator.

1 Hundred Twenty Three Millions, 4 Hundred Fifty Six Thouſand 7 Hundred Eighty Nine.	
.0 1 2 3 4 5 6 7 8 9	Ten Thouſand Million
.0 2 3 4 5 6 7 8 9	Thouſand Million
.2 3 4 5 6 7 8 9	Hundred Million
.3 4 5 6 7 8 9	Ten Million
.0 5 6 7 8 9	Million
.0 0 7 8 9	Hundred Thouſand
.0 0 0 9	Ten Thouſand
.7 8 9	Thouſand
.8 9	Hundred
.9	Tenth

} Parts

5. There

5. There is not, nor can be any Fraction invented, ſo eaſy to work, becauſe ſo like to an intire Number, as the Decimal: for there is the ſame Increaſe of the Places Values in theſe as in Integers, as appears by the following Table, from the One Hundred Millionth Part of a Unit to 100000000 of Units, as 11111111.11111111; and thus every place towards the left hand is ten times that towards the right.

$\frac{1}{100000000}$ Parts;	10 times that, is
$\frac{1}{10000000}$ Parts;	10 times that, is
$\frac{1}{1000000}$ Parts;	10 times that, is
$\frac{1}{100000}$ Parts;	10 times that, is
$\frac{1}{10000}$ Parts;	10 times that, is
$\frac{1}{1000}$ Parts;	10 times that, is
$\frac{1}{100}$ Parts;	10 times that, is
$\frac{1}{10}$ Parts;	10 times that, is
1 or a Unit;	10 times that, is
10 or 10 Units;	10 times that, is
100;	10 times that, is
1000;	or 10 times that, is
10000;	10 times that, is
100000;	10 times that, is
1000000;	10 times that, is
10000000;	10 times that, is
100000000;	*&c.*

6. Decimals are produced from Vulgar Fractions, they being the Quotients ariſing by dividing the Numerator, (with Cyphers annexed toward the right hand) by the Denominator. Hence it follows, that ſome Decimals are *Compleat*, and others *Infinite*.

7. I call that a Compleat Decimal, when nothing remains of the ſaid Diviſion by which the Decimal is made. And to diſtinguiſh a Compleat Decimal, you may put a Period after the laſt Figure towards the right hand thus .0125. and .00375. And thoſe not having ſuch Mark, are ſuppoſed to be Infinite.

The more Places an Infinite Decimal conſiſteth of, the more it expreſſeth the Truth.

I call that an Infinite Decimal, which is no Aliquot Part of the Dividend by the Diviſor that produceth ſuch Decimal, but ſomething will always remain in dividing.

Infinite Decimals are compoſed either of uncertain Digits, as .146129, *&c.* or of thoſe certain and known, as .333, *&c.* .44444, *&c.* The former of theſe ought to have places more or leſs, according to the Uſe that is to be made of them, (for which I have given a Table to direct at the beginning of Diviſion, *Sect.* 6. following.) But Infinite Decimals compoſed of certain Digits, may for ſhortneſs

ſhortneſs be wrote thus: The Decimal of $\frac{1}{3}$ which is .33333333, &c. may be .3*r* that is, 3 *repeated infinitely*; or if a Digit repeat after others are in the Quotient, they will ſtand thus:

.83 *r* 1 which ſhews that 1 (or the 3) is only repeated.

.285714285714, &c. hath 6 repeating, wrote thus .285714*r*6 And ſhews that 6 of the Digits next the left hand would be repeated by carrying on the Diviſion *ad infinitum.* And theſe by ſome are called circulating Numbers, all which kinds of Decimals are produced by Diviſion thus:

Diviſors.	*Digits divided.*	*Decimals ariſing.*	*Diviſors.*	*Digits divided.*	*Decimals ariſing.*
9	8.0	.8 *r*	7	6.000000	.857142 *r* 6
	7.0	.7 *r*		5.000000	.714285 *r* 6
	6.0	.6 *r*		4.000000	.571428 *r* 6
	5.0	.5 *r*		1.000000	.142857 *r* 6
	1.0	.1 *r*	6	5.00	.83 *r* 1
8	7.000	.875.		4.	.6 *r*
	5.000	.625.		1.00	.16 *r* 1
	3.000	.375.	5	4.0	.8.
	1.000	.125.		3.0	.6.

A mixt Number (or one compoſed of a whole Number and Decimal) is thus written 365.125.; 1728.34617, and 252.6*r*, &c.

And this ſhall ſuffice to ſhew the Nature of Decimals, and how to read and write any. I ſhall next paſs on to Reduction, and the reſt of the Rules, inſerting only ſuch Examples as are likely to accrue in Practice; and avoiding all thoſe that are impertinent, and tend to perplex the Reader, and make this Part of Arithmetic abſtruſe and tedious, which in reality is moſt eaſy and obvious.

SECT. II. *Reduction of Decimals.*

IT is almoſt as improper to treat of Addition and the other Rules before this of Reduction in Fractions, as to teach Reduction before the Parts of ſingle Arithmetic in Integers: for what can be more irregular, than to ſhew how to add, ſubſtract, &c. thoſe Numbers, which you neither know the Production of, nor how to diſcover

diſcover what Parts of Coin, Weight, &c. they repreſent or include? Therefore

I ſhall, as is uſual, as well as juſtly and methodically done, in the next place ſhew how to reduce Vulgar Fractions of inferior Denominations to Decimals of ſuperior, conſidered as Integers of thoſe Fractions; and, by way of Proof thereof, give Rules and Examples to find the Values of thoſe Decimals or any other.

I. *To reduce Vulgar Fractions into Decimals.*

A Decimal of 4 places, nay generally of 3, is ſufficient, when that Decimal is not to be multiplied by any Number: Therefore the Denominator of a Decimal of 4 places being (as ſhewed before) 10000, the Proportion will be for any Fraction in general, to find the Numerator of ſuch a Decimal;

As the Denominator of the Fraction given
Is to the Numerator of that Vulgar Fraction::
So is the Denominator of the Decimal (admit 10000)
To its Numerator, or the Decimal required.

Example.] What is the Decimal of $\frac{2}{3}\frac{7}{9}$?

Here it may be obſerved,

Rule = As 39. 27 :: 10000. .6923 = the Anſwer.

39) 2700000 (.6923
.....
360
90
120
30

1ſt, That a Cypher next the right hand of my Decimal may be omitted, becauſe the ſame place in the Denominator is a Cypher alſo: Thus $\frac{1390}{10000}$ is $\frac{139}{1000}|\frac{0}{0}$, and $\frac{13000}{100000}$ is $\frac{13}{100}|\frac{000}{000}$: that is, $\frac{139}{1000}$ is equal to $\frac{1390}{10000}$, and $\frac{13}{100}$ to $\frac{13000}{100000}$, in their loweſt Terms.

2dly, *Note for a General Rule, That you muſt always ſet off with a Point ſo many places of the Quotient for your Decimal, as the Number of Cyphers in the propoſed Denominator,* (*according to the beginning of the laſt Sect.*) *And if there be not ſo many Figures in the Quotient, as there are Cyphers in the Denominator given, then that Number muſt be made up by putting Cyphers towards the left hand next the Point in the Quotient or Decimal.*

3. Hence it follows, That *to reduce Coin, Weight, Meaſure,* &c. *to the Decimals* of an higher Denomination, may eaſily be done, by firſt repre-

repreſenting them in Vulgar Fractions, and then reducing thoſe Vulgar to Decimal, as above.

So to reduce $3\frac{1}{4}d.$ to the Decimal of a Pound, I conſider that this is 13 Farthings, and that a Farthing is $\frac{1}{960}$ of a Pound: therefore 13 *qrs.* is $\frac{13}{960}$ of a Pound. So that

960. 13 :: 10000. .0135 = the Decimal ſought.

Hereupon multiplying and dividing, I find the Quotient 135; but becauſe there are 4 Cyphers in the Denominator (or 10000) given, therefore I muſt have 4 places towards the right hand of the Point for the Decimal, which 4th place I make up with a Cypher, as you ſee; and the Converſe of this Proportion reduceth any Decimal to a Vulgar Fraction; or one Vulgar Fraction may be reduced to any other, whoſe Numerator or Denominator is given. For

135, *&c.* 10000 :: 13. 960 or 10000. 135, *&c* :: 960. 13

Or if you would reduce the given Vulgar Fraction to another whoſe Denominator is 12372, the Proportion holds thus:

960. 13 :: 12372. $167\frac{5}{12}\frac{16}{32}$

So that $\frac{1672}{12}\frac{3}{32}$ is near equal to $\frac{13}{960}$ or .0135

Which may ſuffice to ſhew how to reduce any one Fraction to another, and conſequently a Vulgar to another whoſe Denominator is 10, 100, *&c. i. e.* any Vulgar to a Decimal.

And this puts me in mind of a new kind of Decimal that might be contrived, which would not only admit of being expreſſed in one Line as the common Decimal; but whereas that Decimal ſaves much of Diviſion (which is its Excellency) ſo this new one would ſave much trouble of Multiplication: and that is, by reducing all Vulgar Fractions to one whoſe Numerator is 10, 100, 1000, *&c.* And the Numerator might be ſhewn, by pointing over the Figure in the Denominator, where the 1 or place next the left hand of the Numerator would fall: thus $\frac{1472}{10}$ is wrote 1472: $\frac{1472}{100}$ is 1472; and $\frac{1472}{1000}$ 1472 But I ſhall leave this Notion to be improved by the Ingenious, if thought worth their while; and beg the Reader's pardon for this *ſmall* Digreſſion, which there is not room in this Book to enlarge on.

II. *To*

II. *To reduce Weight*, &c. *to Decimals, as* per *Rules Parag.* 2, 3, &c. *above.*

			Decimals required.
1. In Averdupoize	*qrs.* ℔. 3 : 20, is $\frac{104}{112}$ C.	And 112. 104 :: 10000.	.9285
	18, is $\frac{18}{112}$ C.	And 112. 18 :: 10000.	.1607
	℥. *dw. gr.*		
2. In *Troy* Weight	11 : 12 : 10, is $\frac{578}{5760}$.	And 5760. 5578 :: 10000.	.9684
	Gal. Pint.		
3. In Liquid Measure this Vulg. Fraction of a Beer-Barrel	1 : 3 : is $\frac{1}{288}$.	And 288. 11 :: 10000.	.0382
4. In Dry Measure	1 Pint is $\frac{1}{512}$ of a Qr.	And 512. 1 :: 10000.	.0019
5. In long Measure	1 Yard is $\frac{1}{1760}$ of a Mile:	And 1760. 1 :: 100000.	.00056

And thus I have fully ſhewed the Fundamentals of making Decimals. I ſhall proceed in the third place,

III. *To find the Values of Decimals.*

Note, That .9 of any loweſt Denomination, or .999 of an higheſt, may be taken for a Unit, as in the laſt of the 3 firſt Examples following, *&c.*

To find the Values (as in theſe Examples) you muſt multiply as in the 2d, 4th, 6th, and 8th Columns.

Value.	*Decimals of a L. Sterl. as* .0135 by 20 *s.*	*Value.*	*Decimals of* 1 Cwt. *as* .9285 by 4 *qrs*	*Value.*	*Decimals of* 1 ℔. *Troy, as* .9684 by 12	*Value.*	*Decimals of a Barrel Beer, as* .0382 by 4
	.2700 by 12 *d.*	*Qrs* 3	.7140 by 7 *l.*	℥ 11	.6208 by 20		.1528 *Firk.* by 9 *Gal.*
Pen. 3	.2400 by 4 *qrs*	4	.9980 by 4 *l.*	*dw.* 12	.4160 by 6	*Gal.* 1	.3752 8 *Pints.*
	.9600	℔ 19	.9920	2	.4960 by 4	*Pints* 3	.0016
or 1 *Farth.*		or 20 *Pound*		*grs* 9 *or* 10	.9840		
1	2	3	4	5	6	7	8

And cut off as many Places from the right hand of each Product, as there are in the Decimal given. Theſe prove the Examples above of the ſame Denominations.

Note, That in the 2d Example I multiply .7140 by 7, and that Product by 4, inſtead of multiplying .7140 by 28, the Pounds in a Quarter of an Hundred. And in the 3d Example, becauſe I cannot multiply .4160 by 24, as by 1 Figure, therefore I firſt multiply it by 6, and that Product by 4; which Methods produce the ſame thing as multiplying .7140 by 28, and .4160 by 24, only there is Addition ſaved in each Example.

IV. *A ſecond Way to find the Decimal of any thing, deduced from the four laſt Examples.*

From a due Conſideration of the laſt Examples, you may by a direct contrary way of Operation find the Decimals of any Denomination, here dividing, whereas there you multiplied. For inſtance,

Divide by	*To reduce to a Decimal of a Pound.*	*Quotients or Anſwers.*
	l. 0	.01354161 = 3d *qu.*
20	*s.* 0	.27083 r 1 = 2d *quo.*
12	*Pence* 3	.25 = 1ſt *quote.*
4	*Farth* 1	

Divide by	*To reduce to a Decimal of* 1 *C.*	*Quotients or Anſwers.*
	C. 0	.92857 = 3d *qu.*
4	*qrs* 3	.71428 = 2d *qu.*
7	5	. = 1ſt *quote.*
4	lb 20	

Divide by	*To reduce to a Decimal of l. Troy.*	*Quotients or Anſwers.*
	l.	.9684 = 4 *quo.*
12	℥ 11	.62083 r 1 = 3q.
20	*dw.* 12	.416 r 1 = 2d q.
6	2	.5 = 1ſt *quote*
4	*gr.* 10	

1. Having put down your Denominations that you would reduce into the Decimal of an higher, as you ſee in theſe Examples, begin at the loweſt to divide by the proper Diviſor for reducing into the next ſuperior Denomination, putting, or imagining, Cyphers to ſtand in the Decimal places toward the right hand. But,

2. You will obſerve from theſe Examples, that the mixt Numbers, as 3.25 Pence, 3.7428 Quarters of a *C.* are the Dividends, and that the Decimals are the Quotients: Thus I firſt divide 1 Farthing or 1.00 by 4, and put the Quote to the right hand of the 3 Pence for the Decimal of a Penny; then I divide 3.25 by 12, *&c.* But,

3. In the ſecond Example, inſtead of dividing lb 20 by 28, I divide it at twice by 4, and that Quote by 7; and alſo in the third Example, inſtead of dividing by 24 Grains, I (in this Caſe putting down

down only the Quotient, and doing the reſt mentally) divide by the Digits 4 and 6, which amounts to the ſame thing.

V. *Some brief Ways of Reduction of Decimals.*

There are in many Inſtances much ſhorter Ways both of making Decimals and of finding their Value.

1. As to the firſt, any even Number of Shillings under 20 are reduced to the Decimal of a Pound, by taking half thereof; and thus you ſee in the Margin.

The Decimal of 6 *s.* is .3 *l.*
12 —— .6.
14 —— .7.
18 —— .9.

2. Any odd Number of Shillings under 20 are made Decimals of a Pound by putting a Cypher towards the right, and then taking the half, as in the Margin.

s.	*l.*
3.0 =	.15
9.0 =	.45
13.0 =	.65
17.0 =	.85

3. From hence it is plain, that any Number of Shillings may have their Decimals put down as ſoon as named, by taking half the even Number; and for the 1 *s.* (in an odd Number) you ſee that it is always 5 in the 2d place from the Point.

4. *To put any Pence and Farthings down in the Decimal of a Pound, conſider what Farthings they make, and put them down in the 2d and 3d places from the Point: But after the Farthings are* 24 *or more, add* 1 *to the third place in the Decimal. And thus* 19 s. 7 d. $\frac{3}{4}$ *is put down in a Decimal immediately* .982; *for the* 19 s. *is* .95, *and the* $7\frac{3}{4}$ *is* 31 *Farthings, more* 1 *becauſe* 1 *muſt be added at every* 24, *is* 32; *which added to the 2d and 3d places from the Point in* .95, *the Sum is* .982. And,

5. If you deſire to be ſo exact to have a 4th place from the Point, you may make the Figure in the 4th place 1 more than a 3d of what Farthings are in the Farthings given, when they do not exceed 23. As in the 3d Example of the 4 in the Margin, for 16 *s.* I put 8; for 9 *d.* $\frac{1}{2}$ or 38 Farthings I put 39 in the 2d and 3d places, becauſe 38 is 13 above 25. Then for the 3d place I take $\frac{1}{3}$ of 13, which is 4; to which I add 1, and the Sum is 5 for the 4th place from the Point.

s.	*d.*	*May be put in Decimals.*
8 :	$4\frac{1}{2}$	—— .4187
13 :	$2\frac{1}{4}$	—— .6594
16 :	$9\frac{1}{2}$	—— .8395
19 :	$11\frac{3}{4}$	—— .9989

So alſo in the 4th Example for the 19 *s.* I put .95, for the 6 *d.* of the $11\frac{3}{4}$, I put 25, (that is, 1 added at 6 *d.*) laſtly, for the 5 *d.* $\frac{3}{4}$ (the reſt of the $11\frac{3}{4}$, or 23 *qrs.*) I put $\frac{1}{3}$ of 24, more 1.

For *note*, That when the Farthings given are under, or ſo much as they are more than 24, you muſt take a third part of that Sum they are next to, which can be divided without a Remainer; as in the laſt, I take $\frac{1}{3}$ of 24, becauſe 23 is nearer 24 than it is to 21.

And thus the Decimal of a Pound may be wrote to 4 places at once, or mentally computed, in a fifth part of the time it can be found by the nearer of the Ways above, and that near enough the Truth, unleſs it be required to be multiplied, as is before mentioned, and as in the Table at the beginning of Diviſion.

6. The Value alſo of any Decimal of a Pound may be found by Inſpection: For if the place next the Point be doubled, it gives the Shillings, to which add 1 s. *ſo often as the* 2*d place is* 5 *or more, for the reaſon under the* 2*d Rule above; then call what is under* 5 (*or more than* 5) *in the* 2*d place ſo many Tens of Farthings, and the Digit in the* 3*d place ſo many Units; and as often as they are* 25, *make them leſs by* 1.

	l.	*s.*	*d.*	*q.*
.912 =	18	: 2	: 3	$\frac{1}{2}$
.123 =		2	: 5	$\frac{1}{2}$
.754 =	15	: 1		
.8766 =	17	: 6		$\frac{3}{4}$
.9877 =	19	: 9		

Or more accurately thus; tho the Rule above may be thought near enough, as not erring a Farthing:

If the Farthings under or above 5 in the 2d place from the Point, and thoſe in the 3d place be

6, and under 19,	deduct	$\frac{1}{2}$ a Farthing.
19, —— 33,	——	1
33, —— 45,	——	$1\frac{1}{2}$
45 and upward	——	2

And ſo often as the 4th place is 6 or more, you may add half a Farthing.

And after this manner you may read Decimals in Shillings, Pence, *&c.* as faſt as if they were wrote ſo; as I have examined many a thouſand, having the Species read to me looking on the Decimals, which if continued to ever ſo many places, they alter not the Rules above.

Note, That theſe Allowances or Deductions are made becauſe the Rule ſuppoſeth 1000 Farthings in a Pound *Sterling*, whereas there are but 960; *therefore* if 1000 Farthings is 40 more than the Truth, 500 is 20 more, 250 is 10, or 25 is 1 too much. And it is ſufficient if done to a Farthing, which Decimals may be valued without regarding the 4th place.

7. To find the Value of the Decimal of a Foot in Length by Inſpection.

Rule. *For every* 10*th of a Foot reckon as many Inches and as many Quarters, under* .5, (*which is known* 6 *Inches.*) 2dly, *For every* 2 *in the* 2*d place add* 1 *quarter of an Inch.* And this will not err a quarter

quarter of an Inch in the generality of Decimals, if in any.

Here in the 2d Example	*In.*	*qr.*
.2 according to the Rule is	2	2
and .08 is half ſo many qrs. =	1	—
Sum =	3	2

Foot.	*Inch.*	*qr.*	
.37 =	4	2	*Examples.*
.28 =	3	2	
.73 =	8	3	
.92 =	11	1	

And in the 4th Example,

.9 ; .5 I ſay is	6	—	
.4 is 4 *inch.* 4 *qr.* or	5	—	
.02 is — — — —	—	1	
Sum =	11	1	

Note, That in adding half, in the 2ds place, if odd, you may omit the odd, and take half the next leſſer even Number, as in .07 and .03 I take only 3 *qrs.* and 1.

The immediate writing down any Inches and Quarters in the Decimal of a Foot is done ſo eaſily by the Rule above inverted, that there is no occaſion for Examples.

8. *To find the Value of the Decimal of a Gallon by Inſpection.*

Rule.] *Multiply the Digit in the Primes place of the Decimal by* 8, *and the Digit next the left hand of the* 2 *Digits in the Product is ſo many Pints; then add the Digit next the right hand of the Product to that in the* 2ds *place of the Decimal given, and multiply that Sum by* 4, *and the place next the left hand of the Product are Quarters of Pints.* Which is done with about a third of the trouble in the common way; and gives the Anſwer accurately enough.

Gall.	*Pints.*	*qrs.*	*Gall.*	*Pints.*	*qrs.*	*Gall.*	*Pints.*	*qrs.*
.19 =	1	2	.64 =	5	—	.34 =	2	3
.28 =	2	1	.73 =	5	3	.71 =	5	2
.37 =	3	—	.82 =	6	2	.66 =	5	1
.46 =	3	3	.91 =	7	1	.88 =	7	—
.55 =	4	2	.11 =	—	3	.99 =	8	—

Thus in .66, 8 times 6 is 48, the 4 are Pints, and the 8 of the Product added to 6 in the 2ds place is 14; 4 times 14 is 56; the 5 are Quarters of Pints or $1\frac{1}{4}$ Pints, which with the 4 is $5\frac{1}{4}$ Pints, &c.

9. *To*

9. *To find the Value of the Decimal of a Barrel of Beer very briefly, and accurately.*

Rule.] *Multiply the given Decimal by* 4, *cut off from the Product* 1 *less than the Decimal places given; then ſubſtract every Digit in the Product from its right hand Digit, and the Remainer is the Value ſought in Gallons and Parts.* Thus in the 3d Example, the Product of .9876 by 4 is 39.504 (cutting but 3 off, according to the Rule:) Then I begin with 4, and take that from (0) which I ſuppoſe next it towards the right hand, that is, from 10, reſts 6; 1 borrow'd and 0 (in Tens place) is 1 from 4 (in Units place) there reſts 3; 5 from 10 reſts 5; 1 borrow'd and 9 is 10 from 15 reſts 5; 1 borrow'd and 3 (next the left hand, Column 2.) is 4, from 9 reſts 5, and 0 from the ſaid 3 reſts 3; which ſaid Reſts are the Anſwers in Column 3, *viz.* 35.5536.

Examples.		*Anſwers.*	*Examples.*		*Anſwers.*
Barrels.	*Products.*	*Gallons.*	*Barrels.*	*Products.*	*Gallons.*
.1234	4.936	4.4424	.2 *r*	8.8 *r*	8.
.5678	22.712	20.4408	.5 *r*	22.2 *r*	20.
.9876	39.504	35.5536	.7 *r*	31.1 *r*	28.
.5432	21.728	19.5552	.9 *r*	39.9 *r*	36.

10. The 2 ſhort Rules above being obſerved, the Decimal of a Barrel is found in Gallons, Pints, and Quarters of a Pint, very conciſely thus:

Example 1.

Barrels Beer .19765

7.9060

Reſts Gallons 7.11540

Pints 0 : 3.6 { *Quarters of a Pint and Parts.*

Example 2.

Barrels Beer .8764

35.056

Reſts Gallons 31.5504

Pints = 4 : 2 *quarters Pints.*

I have contrived theſe 2 laſt for the Uſe of his Majeſty's Officers of Exciſe, where they may almoſt by Inſpection ſee the Value of the Decimal of a Barrel, to the 10th part of a Pint.

11. *A moſt conciſe and eaſy Way to find the Value of the Decimal of a Pound Averdupoiſe Weight exactly.*

Rule 1.] This may be done by this Rule: Multiply the Decimal given by 3, and cut off the Product 2 places fewer than are in the Decimal given; from that Product ſubſtract a 7th of it ſelf; then take a 16 of the Remainer, (which you may do, only putting down

down the Quotient, which are Ounces; and the Remainer (less 1) are Drams, *per* this Example.

2. But the Rule to be insisted upon as more brief and accurate, is this: Multiply the given Number by 8, and double the Product of every 2 Digits as you go on, and the Product is Ounces and Parts. Then multiply in like manner the Parts of an Ounce, and the Product is Drams and Parts.

.924	
277.2	
39.6	
237.6	
℥ 14 : 12 *dr.*	

Example 1.

Given = ℔ .924

Answer { Ounces = 14.784 / Drams = 12.544

Example 2.

℔ .567

Oun. = 9.072

Dr. = 1.152

Example 3.

℔ .234

Oun. = 3.744

Dr. = 11.904

Or if it be thought burdensome to the Memory to multiply by 8, *&c.* as *per* the Rule above, it will be more easily done thus:

Rule 3.] *Multiply the Decimal given by* 6, *and after you have added the Tens carried (as usual) add thereto the Digit next towards the right hand of that which you last multiplied, and put down what is above* 10 *(as commonly:) But when you have multiplied the Digit next the left hand, add the Tens carried to that Digit.* For instance, in the first Example above say 6 times 4 is 24, put down 4, and carry 2; 6 times 2 (the next Digit) is 12, and 2 carry'd is 14, and the 4 in Units place is 18, put down the 8, and carry 1; 6 times 9 is 54, and 1 carry'd is 55, and 2 (the middle Digit) is 57; put down 7, and add the 5 carry'd to the 9 last multiplied, and that makes 14: which I take to be the most concise and easy Method that this thing is capable of, unless as by the following

Rule 4.] Take the Primes place for so many Ounces, Halfs and Tenths of an Ounce; Seconds place for so many 2.5 Drams; and Thirds place for so many Quarters of a Dram.

Example. In .924 ℔. .9 is 9 Ounces, 9 Halfs, and .9 = Oun. 14: 6 Drams. 2 in Seconds place is 2 times 2.5 or 5 Drams; and 4 in Thirds place is 1 Dram = 14 Oun. 12 Dr.

12. *The most easy and short Way of finding the Value of a Decimal of* 1 ℔ *Troy Weight in* ℥, dw. *and* grs.

1*st*, Multiply the Decimal given by 2, and add what is carry'd, and the Digit next the right hand (as in the third Rule) gives the Ounces.

2*dly*, Twice Primes place in the next Decimal of Ounces is so many Penny-weight; and every 5 in the Seconds place is 1 more.

3*dly*,

3*dly*, What the Seconds place is under or above 5, and the Thirds place; take half thereof for Grains. But if they are 25 or upward, deduct 1; if 38 or upward, deduct 2. And if the Digit in Thirds place be an odd one, you may deduct only the odd one at 25, and 1 and the odd one at 38, *&c.*

Examples. ℥. *dw. gr.*
℔ .5642 or 6 : 15 : 10
℥ 6.7704 do this by Inſpection.

℔ .9782 or 11 : 14 : 18 | *dw. gr.*
℥ 11.7384 by Inſpection is 14 : 18

SECT. III. *Addition of Decimals.*

THIS Rule has no more difficulty than that of one Denomination in whole Numbers: obſerving,

1. To place the Decimal Places next the Point, or the ſeveral Places next the left hand, and the Points themſelves, *&c.* one under another, as in the Examples.

2. If the Decimals to be added exceed not 5 in number, it is ſufficient if they conſiſt of 5 places where the Sum is not to be multiplied by any thing; but where it is to be multiplied, you muſt obſerve the Rules given in the beginning of Diviſion, *Sect. 6.* of this Chapter. And if Decimals of a Pound *Troy* are to be added, the Decimals to be added ought to conſiſt of at leaſt 6 places: But if the Decimals be compleat, 'tis no matter how few the places be.

Example 1.

.925.
.0775.
.5.
.25.
.75.
.05.
.125.

Sum 2.6775.

Example 2.

Decimals of a Pound Sterl.		*Value in Specie.*
.9.	——	18 *s.* — *d.*
.05.	——	1 : —
.125.	——	2 : 6
.75.	——	15 : —
.775.	——	15 : 6
.65.	——	13 : —
.825.	——	16 : 6
.15.	——	3 : —
Sum 4.225.	=	*l.* 4 : 4 : 6 Sum Proof.

3. But

3. But becauſe the Decimals that occur in Practice are generally, if not always promiſcuous, that is, neither all compleat Decimals, nor infinite, (certain or uncertain) therefore Examples of ſuch mixt will be the moſt uſeful.

Example 3.
Of a mixt Number.

198765.
19876.5.
1987.65.
198.765.
19.8765.
1.98765.

Sum 220849.77915.

Example 4.
Promiſcuous Decimals.

.17565
.6*r*
.72939
.5.
.17234
.97548
.9*r*
.87654
.25.
.09842

Sum = 5.44447
or = 5.44486*r*1

Example 5.
Promiſcuous Decimals,
&c.

.9666666
.12345
7.6777777
4.00276
.9879879
.12729
.9.

14.78593 Sum.
or 14.7859324*r*3

By the 3 firſt Examples you ſee how eaſy the Addition of Decimals is, when placed as they ought to be, and ſo many are cut off for Decimals in the Sum, as are the greateſt Number of places of thoſe given; which is ſufficient for the underſtanding of this Rule.

But becauſe ſome have made a difficulty where there was none, by talking much of repeating Numbers; I have given the two laſt Examples, to ſhew that the common Method is accurate enough, without taking notice of repeating Digits as differing from others.

In Example 4. there being 2 Decimals conſiſting of repeating Digits, I put down only thoſe next the Point, and ſum up them, 1ſt ſaying 9 and 6 is 15, and 1 carry'd (ſuppoſing the 9 and 6 which repeat were placed 2 places more to the right hand than 5 places, the greateſt Number given) is 6: which I put down as you ſee in the loweſt Line, and ſay 1 and 2 is 3, and 4 is 7, and 8 is 15, and 4 is 19, and 9 is 28, and 5 is 33, and (coming downward again, at every Series you add upward, with the repeating Digits) 6 is 39, and 9 is 48; put down 8, and carry 4 to the next Series, which makes it 29, and the 6 and 9 repeating is 44; put down 4, and carry 4 to the third Series, which makes it 39, and the 6 and 9 Repeaters is 54; put down 4, and ſo proceed in like manner to the Digits next the Points, where the 6 and 9 are added in courſe, as being there placed; ſo the Sum

is 5.444486 7 1. And if you had filled only 5 places each with the 2 Digits that repeat, and had added them as the 3 former Examples, the Sum would have been the ſame, wanting only .000016, which ſuppoſing even the Decimal of a Pound *Troy*, is leſs than a 10th of a Grain. And in the 5th Example the difference between the Sums having regard to the repeated Digits, and the Sum the common way is ſo inconſiderable, as appears by the 2 Sums; not worth notice, if the 2d Rule of this Section be obſerved.

I have demonſtrated in the 2d Example, by the Addition of the Specie anſwering the Decimals, that the Rules for adding Decimals are right: I ſhall here ſhew *that the Rule for adding theſe is agreeable to that for Vulgar Fractions.* For example, in adding $\frac{365}{1000}$ to $\frac{96}{100}$, the common Denominator is 100000, the Numerators 36500 and 96000, the Sum of which is 132500; ſo the Anſwer, cutting off the Cyphers as uſeleſs, is $\frac{1325}{1000}$: and dividing the Numerator by the Denominator, that is, cutting off 3 Figures, the Anſwer is 1.325: But the ſuperfluous trouble of putting down the Cyphers being omitted, the Work of Addition of Decimals is as above, and as *per* Margin.

.365
.96
1.325

SECT. IV. *Subſtraction of Decimals.*

THERE is no difference between the Method of this and Intire Numbers, obſerving to place the Point of the Subtrahend exactly under that of the greater Decimal. Two or three Examples will ſuffice to ſhew it.

Example 1.	*Example* 2.	*Example* 3.
From .9876.	From 98.76	From 9876.
Take .87654321	Take .08765	Take = .1234
.11105679 Remains	= 98.67235 Remains	= 9875.8766

Example 4.	*Example* 5.	*Averdupoize Weight.*
		lb. *Oun. Drams.*
From 123.45	From *l.* 1.0976 ..... or from	1 : 1 : 8.9856
Take 97.	Take = .987 ..... or take	—: 15 : 12.672
Reſts = 26.45	Difference .1106 ..... or =	—: 1 : 12.3136

The

The Reaſon of the Work of Subſtraction of Decimals is the ſame as is ſaid of Addition, only ſubſtracting inſtead of adding the Numerators; agreeing exactly with the Deduction of Vulgar Fractions, in which Method if the Cyphers be neglected in the Reſults, the Method falls juſt into that of Subſtraction of Decimals, where the cutting off from the Sums, Remainers, Products, *&c.* is the ſame as dividing by a Unit with Cyphers (which is the Nature of the Denominators of Decimals) as is ſhewed in Diviſion of Intire Numbers.

SECT. V. *Multiplication of Decimals.*

THERE is no difference between the Operations here and by Integers, but obſerve this Rule:

After the Work is over, you muſt ſet off ſo many Figures towards the right hand of the Product, as you have Decimals in both the Factors.

But if ſo many places are not in the Product (as it will happen when you multiply Decimals of ſmall Value) then you muſt make up that Number by placing Cyphers towards the left hand of the Product next the Point.

Example 1.
A Decimal by an Integer.

.012345.
932

24690
37035
111105

11.505540

Example 2.
A mixt by a mixt Number.

9.37241.
25.324.

3748964
1874482
2811723
4686205
1874482

237.3469 1084

Example 3.
A mixt Number by a Decimal.

36.252.
.00032.

72504
108756

.01160064

Example 4.
A Decimal by a Decimal.

.12564 *r* 1
.00009

.00001 13079 *r* 1

Note, That in the fourth Example, becauſe the 4 is repeated *ad infinitum*, therefore I ſay, 9 times 4 is 36, and 3 (which would be carry'd if you actually put down another 4) is 39; put down 9, and carry 3.

Now if you had put down and multiplied 100 Fours of thoſe repeated, ſo many Nines would alſo be repeated in the Product; but for brevity-ſake I only put down one of each with an *r*.

To multiply mixt Numbers, Decimals, &c. *and to have only ſo many Decimals in the Product as you aſſign: And how to avoid all unneceſſary Figures in ſuch Operations.*

Caſe 1. A mixt Number by a mixt, as 1.234504 by 9.2123. and to have only 4 Decimals in the Product.

1.234504
3212.9. = the Multiplier inverted.

---

1 1 1 1 0 5
2 4 6 9
1 2 3
2 5
4

11.3726 = the Product.

Caſe 2. A Decimal by a whole Number, as .1234504 by 92123, and to have 3 places in the Product Decimals.

.1234504
32129 = the Multiplier inverted.

---

1 1 1 1 0 5 3 6
2 4 6 9 0 1
1 2 3 4 5
2 4 6 9
3 7 0

11372.621 = the Product.

Caſe 3. A Decimal by a Decimal, and to have only 4 Decimal places in the Product; as .12345 by .92123

.12345
.32129. = the Multiplier inverted.

---

1 1 1 1
2 5
1

.1137 = Product required.

1. To perform theſe Operations, 'tis plain that the Multiplier is inverted, and Units place put next the left hand, *&c.* when you place it down to multiply.

2. The due placing of it is the next thing, which is to put Units place of the intire part under that place in the Decimals of the Multiplicand, which anſwers that place next the right hand of the Decimals you would have in the Product: As in the firſt Example, becauſe I would have 4 places Decimal in the Product, therefore I put 9 (the Units given) under the 4th place from the Point in the Multiplicand. And in the 2d Example, I put 3 (the Units place of the Multiplier given) under the 3d Decimal of the Multiplicand; and in the 3d Example, becauſe I would have 4 Decimals in the Product, I put the Digit next the Point in the Multiplier under the 3d place of the Multiplicand, becauſe there is no intire Number to put under the 4th place; and place all the other Figures of the Multipliers in a reverſe Order, as *per* the Example.

3. Begin to multiply the Figure next the right hand of the Multiplier, when placed as *per* Rules above, into the Figure ſtanding over it, *&c.* as in the common way; obſerving at the ſame time what Tens would be carry'd if you multiplied the next Figure or two toward the right hand, and adding ſuch Tens and half Tens or upward as Ten, and ſo proceed with each Figure in the Multiplier that hath another ſtanding over it, (omitting the reſt) and place the 1ſt Product of each Figure, *viz.* what the ſame is above ten or tens Units, under the Units of the firſt Line, *&c.* and not as in common Multiplication; which Lines add up, and the Aggregate is the Product required. The 3 Examples above make it plain, and that much Trouble and many ſuperfluous Figures are prevented.

Caſe 4. *But it may ſometimes happen*, That, as in the following Example, ſo many places are not in the Sum as you propoſed for Decimals: in which caſe add 1 or more Cyphers.

Thus to multiply .12345 by .234, ſee the Work in the Margin, to have 4 Decimal places in the Product; where the making of 13 Digits are ſaved.

Caſe 5. *Alſo it may happen*, That there are not ſo many Decimal places in the Multiplicand as you propoſe ſhall be in the Multiplier; ſo that yon cannot proceed as *per* Rule 2. above: in this Caſe you may ſup-

```
 .12345.
   432.
 ------
   247
    37
     5
 ------
 .0289 = Product
```

ply

ply the place by Points; thus, to multiply 32.34 by 7.93245 see the Work in the Margin, to bring out 4 places Decimal.

These are all the Variety I could think of as to this matter, which are mostly not extant before that I know of: And the following Compendiums are intirely my own Contrivance; and if any of them are extant, I can assure the Reader I borrow'd nothing therefrom.

```
32.34..
54239.7
-------
22638..
29106.
 9708
  647
  129
   16
-------
256.5354
```

New COMPENDIUMS in Multiplication.

1. To multiply by any Factor under 20 at once.

Example 3.4567
by .19.

.656773 Product.

The common Way

```
3.4567.
   .19.
-------
311103
34567
-------
.656773
```

The Probation

---

2. To multiply by any Factor between 100 and 110 (exclusive) at once.

Example 34567
.108

3733.236 Product.

The common Way

```
34567
 .108
------
276536
345.67
------
3733.236
```

Prob. =

---

3. To muitiply by any Factor between 111 and 119 (inclusive) at once.

Example .34567
11.7.

4.044339 Product.

The common Way

```
.34567
 11.7.
-------
241.969
345 67
34567
-------
4.044339
```

Prob. =

4. To

4. To multiply by any Number between 1111 and 1119 (inclusive) at once.

Example 34567
11.14.
385076.38 = Product.

The common Way = 34567
11.14.
138268
34567.
34567
34567
Prob. = 385076.38

5. To multiply by a Factor between 11111 and 11119 (inclusive) putting only the Product.

Example 34567
111.16.
3842467.72 = Product.

The common Way = 34567
111.16.
207402
34567
34567
34567
34567
Prob. = 3842467.72

6. To multiply by a Factor between 20 and 100 exclusive.

Example 3.4567.
65
224.6855 = Product.

The common Way = 3.4567
by . . 65
172835
207402
Prob. = 224.6855

7. To multiply by a Factor consisting of a Cypher between two Digits.

Example .34567
605
209.13035 = Product.

The common Way = .34567
605
172835
207402
Prob. = 209.13035

8. To

8. To multiply by a Factor consisting of 2, *&c.* Cyphers between two Digits.

Example 34567
6005
Product = 207574835

The common Way 34567
6005
172835
207402
Prob. = 207574835

9. To multiply by a Factor consisting of so many Cyphers between two Digits, as there are Places in the Multiplicand.

34567
6000005
Product = 207402172835

10. To multiply by any Factor between 100 and 200; only putting down the Product.

Example 23456
154
Product = 3612224

The common Way 23456
154
93824
117280
23456
Prob. = 3612224

11. To multiply by a Factor consisting of a Unit between any 2 Digits.

Example 23456
416
Product = 9757696

The common Way = 23456
416
140736
23456
93824
Prob. = 9757696

Thus far by only putting down the Figures of the Product.

12. From

12. From what is above, it is plain that any Number may be multiplied by a Factor, being the Square of any in the Propositions above, or the Rectangle of any two of them, by only making 1 Line besides the Product. For knowing that 1235 is the Product of 65 by 19, multiply for example 34567 by 19 (as *per* Case 1.) produceth 656773; and that by 65 (as *per* Case 6.) produceth 42690245, the same as 34567. by 1235.

	or 34567
	by 66751580
	276536
	172835
	34567
	172835
Examp. 2.	241969
proved.	207402
	207402
Proof =	2307401865860

Examp. 1.	*Examp.* 2.
34567	34567
19	11116
656773	384246772
65	6005
42690245	Prod. = 2307401865860

The Factor 66751580 being the Rectangle of the 2 towards the left hand; therefore 34567 is multiplied by 66751580, by only making 9 Figures besides the Product; which is 32 fewer than must be put down and added in the common way.

---

13. Or if a Factor or Multiplier consist of the Figures in any two of the former Digits, *&c.* put down in course; the same may be performed as follows:

12.345732.	*The common Way* 12.3456732.
11116005	11116005
74135675660 = the multipd. by 6005.	617283660
1372345032912 = the multiplied by 11116.	740740392
	740740392
= 1372419168.6795660 = Product.	12345732
	12345732
	12345732
	Proof = 1372419168.6795660

By this Method there are put down and added 38 Figures fewer than in the common way.

See also the Proof of the last Example in the Book save one, where 9 Places are multiplied by, and only 5 Lines made.

14. To multiply by a whole Number consisting of any Digit repeated any number of times, as suppose by 7 repeated 8 times.

12345678932
77777777

86419752524
. . . . . .

960219462886694164 Product.

Note, This Invention is so much shorter than the common Way, that in this Example there are 77 Figures fewer.

Common Way 1234.5678932.
77777777

86419752524
8641975252 4
864197525 24
86419752524
8641975 2524
864197525 24
8641975252 4
86419752524

Proof = 960219462886694164

---

15. To multiply by a Decimal consisting of any Digit repeated *ad infinitum*, very easily, briefly, and accurately.

Note, This is done with 84 Figures fewer than the common Way, and is about 100 nearer the Truth.

In this Case cut one place more from the Product than the Decimal Places in the Multiplicand, for Decimals of the Product; or so many more than one as there are Cyphers before the repeated Digit of the Multiplier.

1234567893 2
.77777777, &c.

86419752524

Product 9602194724.871

---

16. To multiply by a mixt Number, consisting of any Number of Digits repeated.

Example.

as 12345678932
by = 7777.7777, &c.

by 7 = 86419752524

Product = 960219472488888.871

For Proof of this.

12345678932
by 7777.

= 960123450541 64
and by .7, &c. = 9602194724.8

Sum = 960219472488888.871.

Directions

Directions concerning the 16 Compendiums above.

As to *Compend.* 1.] It is performed as in common Multiplication by 9, only adding the Digit toward the right hand of every one that you multiply by the 9; and when you have multiplied the laſt in order, add what you carry to that Digit next the left hand, and that gives the 2 laſt in the Product.

Compend. 2.] Work as in the laſt, only with this difference, that you muſt add the 7 in Units place to the Product of 8 by 5, and the 6 to the Product of 8 and 4, *&c.* Laſtly, add what you carry to the 4, is 7, and then put down the 3 next the left hand.

Compend. 3.] When there is 1 in Units and 1 in Tens place, beſides a place Decimal, or 114, 116, 117, *&c.* you muſt add to each Product of every Digit multiplied by 7, the 2 next Digits ſtanding towards the right hand, when there are ſo many. As to the Product of 6 by 7, I add the 7 next the 6; and then ſay, 7 times 5 is 35, and 5 carried is 40, and 6 is 46, and 7 is 53; put down 3, and carry 5, *&c.* Laſtly, when you have multiplied the 3 by 7, and added the 4 and 5, add the 3 carried to the 3 and 4 is 10, and 1 carried and 3 is 4.

Compend. 4.] This is performed as the laſt, only adding 3 Figures (when you have ſo many) ſtanding toward the right hand of every Digit which you multiply by the 4. And at laſt the 3 carried is added to 3, 4 and 5 is 15, and the 1 carried (the 5 being put in the Product) added to the 3 and 4 make 8, which put down, and the 3, as you ſee in the Example.

Compend. 5.] Whereas here you have 4 Units towards the left hand, you muſt add 4 Figures (when you have ſo many) ſtanding towards the right hand of every Digit you multiply by 6. And what is carried muſt be added to the 4 places next the left hand of the Multiplicand at laſt, and then 3, and then 2, and then put the 3 in the Multiplicand down.

Compend. 6.] Say 5 times 7 is 35, 5 and carry 3; 5 times 6 is 30, and 3 is 33, and 6 times 7 makes 75; put down 5, and carry 7, and ſay 5 times 5 is 25, and 7 is 32, and 6 times 6 makes 68; put down 8, and carry 6, and ſay 5 times 4 is 20 and 6 is 26, and 6 times 5 makes 56; put down the 6 and carry 5, and ſay 5 times 3 is 15, and 5 carried is 20, and 6 times 4 makes 44; put down 4, and ſay 6 times 3 is 18, and 4 is 22.

Compend. 7.] In this Example, becauſe there is a Cypher between, you muſt multiply the two firſt as uſual, and to the Product of the 5 in the 3d add what is carried, and the Product of the 6 in the firſt or Units place of the Multiplicand. Then to the Product of 5 in the 4th add what is carried, and the Product of 6 in the 2d or 6, *&c.* and laſtly multiply 4, then 3 by the 6, and put the Product down.

Compend. 8.] Multiply as uſual to multiply the 4, then ſay 5 times 4 is 20, and 2 is 22, and 6 times the 7 is 64, 4 and carry 6; 5 times 3 is 15, and 6 is 21, and 6 times the 6 (or 36) makes 57; put down the 7, and multiply the 5, 4 and 3 by the 6, adding the 5 carried.

Compend. 9.] In this and the like Caſes there is no more difficulty than in multiplying by a ſingle Digit; for the Number of Cyphers being equal to the Places in the Multiplicand, the Product by the 6 falls juſt to the left hand of the Product by the 5. But if the Product of the Digit next the left hand by that in Units place, and what is carried, be leſs than 10, then a Cypher muſt be put down between the two Products.

Compend. 10.] This is performed by conſidering the Nature of the Operations of the firſt and ſixth Compendiums. For 4 times 6 is 24, 4 and carry 2; 4 times 5 is 20, and 2 carried and 5 times 6 makes 52, 2 and carry 5; 4 times 4 is 16, and 5 is 21, and 5 times 5 is 46, and 6 in Units place makes 52, 2 and carry 5; 4 times 3 is 12, and 5 is 17, and 5 times 4 makes 37, and 5 (in Tens place of the Multiplicand) is 42, 2 and carry 4: 4 times 2 is 8, and 4 is 12, and 5 times 3 makes 27, and 4 (in Hundreds place) is 31; put down 1, and carry 3. Then (having multiplied all by the firſt Figure) I ſay 5 times 2 is 10, and 3 carried is 13, and 3 in Thouſands place is 16; 1 time 2 is 2, and 1 carried is 3.

Compend. 11.] This is performed as the laſt, only inſtead of adding the Digit next the right hand, *&c.* to the Product of the ſecond Figure in the Multiplier, you muſt here add it to the Product of the firſt Figure, becauſe the 1 ſtands next that Digit; and then you keep to the 1ſt and 6th Compendiums, as in the laſt.

Compend. 12.] By this Compendium is ſhewn how to multiply by 66751580, or other large Number produced by the Multiplication of 2 or Square of one known Number, by only making 1 Line beſides the Product. The Example is that of the 5th and 8th.

Compend. 13.] This is likewiſe an Example ſhewing how the Work of Multiplication by large Numbers may be ſhorten'd, by dividing

dividing such large Number into 2, 3, &c. such Numbers as fall within some of the abovesaid Rules: as 11116600 5 I divide into two Multipliers, 11116 and 6005, &c. done at twice.

Compend. 14.] This Compendium is performed, first, by multiplying the given Number by one of the repeated Digits, as in the Example above the Product is 864197525 24, from which the general Product is found thus; Add that Product from the right hand toward the left, and say 4 and 2 is 6, and 5 is 11, (put down the 4, 6 and 1, and for every 10 you arrive at, put 1 to the Sum more than what is wrote down) and 1 is 12, and 2 is 14, and 5 is 19, and 7 is 26, put down the 4, 9 and 6; then adding 1 more for the 2d 10, I say, and 1 is 27, and 9 is 36, and 1 (for that 3d 10) is 37, and 1 next the 9 is 38; so I put down the 6 and 8.

Then becaufe I have added as many places as are in the Multiplier, I leave out Units place (4) and add from 2 in Tens place to 4, the 3d Figure from the left hand inclufive, which with the 3 carried (part of the faid 38) makes another 38; put down that 8, and carry 3, fo adding that to 5, &c. to 6, the 2d Figure from the left hand (leaving out the 2 firft Figures next the right hand) that Sum is 42; I put down the 2, and carry 4, adding that to 2, (the 4th from the right hand, leaving out the 524) and fo forward to 8, next the left hand inclufive, the Sum is 46: I put down the 6, and add the 4 to the Figures between 5 and 8 inclufive, (leaving out the 2524) and the Sum is 44; I put down 4, and add 4 to the Figures between 7 and 8 inclufive, (leaving out the 52524, and fo every time I leave out 1 more) as 4 and 7 is 11, and 9 is 20, &c. to 8 makes 39; put down the 9, and add 3 to 86419, as they ftand from the right to left, as before, and the Sum is 31: put down 1, and add 3 to 8641, as taught before, and the Sum is 22; put down the 2, and add 2 to the 864 as aforefaid, and the Sum is 20; 0, and carry 2 and 6 is 8, and 8 is 16; put down 6, and fay 1 and 8 is 9: fo have you the Anfwer only by eafy Additions.

Compend. 15.] If the repeated Figure be a Decimal for the Multiplier, I multiply as before to gain the 864197525 24; whence the Product is found firft by adding that whole Line from the right to the left hand, which makes 53: I add the 5 to the 3 is 8, which I put down for the repeating Digit of the Product. Then add the 5 carried to 2 (in Tens place) and that to the reft of the Line towards the left hand makes 54; put down the 4, and carry 5 to the 5, (in Hundreds place) &c. adding all toward the left hand as before, leaving out 1 toward the right for every Digit put in the

Sum:

Sum: which is a moſt eaſy and brief Way of anſwering all Queſtions of that kind.

Compend. 16.] If the Multiplier be a repeated Digit and a mixt Number, you have nothing to do more than in the laſt Compendium: only to put ſo many of the repeated Digits towards the right hand of the integral part of the Product, as there are places in the integral part of the Multiplier, as in the Example 16. above.

A ſecond Example of the 16th Compendium, to multiply 1234 by 333·3333333, *&c.* or 333·3 *r*. See the Operation.

Multiply 123·4
by . . 333·33333333, *&c.*

3702

411333·3 *r* = Product.

Proved thus 1234
as *per* 15th by ·3 ·3 *r*

is = 411·3 *r* 1
and by 333 = 410922

Sum = Proof = 411333·3 *r*

In this (as the laſt) having multiplied the 1234 by 3, it produces 3702, which I add from the right hand towards the left, and the Sum is 12; ſo 2 and the 1 is 3 = the repeating Digit, and 1 carried added to 0, 7 and 3 is 11: I put 1 down, and carry 1 and 7 is 8, and 3 is 11; put 1 down, and carry 1 to 3 makes 411·3 *r*; and becauſe there are 3 places Integers of the Multiplier, I therefore put 3 places of the repeating Figure towards the right hand of the 411, makes 411333·3 *r* the true Anſwer, as by the firſt Example and Rules for working the ſame under the laſt mentioned Compendium.

17. Or if it ſhould be ſuppoſed (tho ſuch a thing does not often happen) that the Decimal Digits repeat in both the Factors; then work as under the 15th Compendium, and to that Reſult add the Product by the next, *&c.* Digits, putting down what would be carried if the Decimal Digit were really repeated.

Example. 3·6 *r*
4·3 *r*

Product = 110

Sum = 1·22 *r*
Product = 14·6 *r*

Sum = Anſwer = 15·8 *r* 1

Proof $3\frac{2}{3} = \frac{11}{3}$
$4\frac{1}{3} = \frac{13}{3}$
and $\frac{11}{3}$ by $\frac{13}{3} = \frac{143}{9} = 15.8r1$

18. But

18. But if the repeating Digits in both Factors begin after the Primes place, (altho the Case may rarely happen) you may proceed as in the following Example.

To multiply 27.16*r* 1 by 5.23 *r* 1.

27.1666666, *&c.*
5.23333333, *&c.*

.8150 = Product by .03 in 27.16*r* 1

.905*r* 1 = Sum of the last Line, as *per* 15th, *&c.* Compend.
5.433*r* 1 = 27.16*r* 1 in .2
135.833*r* 1 = 27.16*r* 1 in 5

142.172*r* 1 = the true Product, or Sum of the three last Lines.

I need say no more to illustrate the last Example; and having now finished what I thought might be of real use in Operations of Multiplication, whether by Decimals or Integers; I shall not trouble my Reader with useless as well as troublesome and tedious Speculations. But for the Solution of all Questions in Practice, as of Concrete Numbers, I refer to the third Rule in the next Sect. (6.) for making your Decimal longer or shorter, as occasion requires, according to the Greatness of the Number by which such Decimal is to be multiplied: for which purpose a Table is there inserted, to direct on almost all Occasions.

These 18 Compendiums, as well as the 3 or 4 Cases preceding them, are new to me; tho I am since my writing them informed, that one or two of the first and most easy of these Compendiums are in Mr. *Lyburn*'s Arithmetic: however that be, I have no reason to omit any, as being my own Contrivance.

These Operations, altho at first they may seem difficult, and to burthen the Memory; yet I can assure the Reader, that by Use they will become as easy as common Multiplication, (as I know by Experience) and that they very much abbreviate the Operations, cannot be deny'd: nay, many of these new Compendiums are not only shorter, but easier and more accurate than the common Way. And I doubt not but these, and those many in Reduction of Decimals, being new and great Improvements, will be accordingly received by the Ingenious.

That Multiplication of Decimals is done by the same Rule as Vulgar Fractions.

To instance in multiplying .126 by .74: According to the Rule of Vulgar Fractions, the Product of the Numerators is 9324, of the Denominators 100000, the new Fraction $\frac{9324}{100000}$ as a Vulgar; or as a Decimal, by the Rule in Notation, .09324, that is, 9324 being divided by 100000, quotes .09324.

.126 } Numerators.
.74 }

9324 Product.

Denominators { 1000 / 100

Product = 100000

that is $\frac{9324}{100000}$ as Vulgar.
or .09324 as Decimal.

Hence appears *wherein the Preference of the Decimal Fraction consists*: As,

1. In the easy Multiplication of the Denominators, which is only putting the Cyphers of the one toward the right hand of the other.

2. In that the Decimal can be expressed without its Denominator. And,

3. In case of finding the Value of the Decimal Fraction, the dividing by the Denominator is done by Inspection, which in Vulgar Fractions often requires a tedious Operation, *&c.*

SECT. VI. *Division of Decimals.*

THIS Rule is the same, as to the Operation, with Division of Intire Numbers; but it must be observed,

1. *To know how many Cyphers to add to the Dividend, that so the Quotient may have a competent Number of Decimal Places,* take this *Rule.* Consider how many Decimals will suffice to be in your Quotient, (upon the Foundation of the Rule of Decimals, as *per* the little Table following the next Rule) and add that Number to the Decimal Places in the Divisor, and then make the Decimal Places in the Dividend equal to that Sum, by putting Cyphers toward the right hand, if need be.

2. *To know (when the Work of Division is ended) how many Places of the Quotient are Decimal.*

Rule. The difference between the Decimal Places in the Dividend and Divisor, are the Decimal Places toward the right hand of the Quotient.

But

But if ſo many Places be not in the Quote as the ſaid difference is, you muſt make up that Number by prefixing Cyphers towards the left hand, as *per* the Rule in Reduction.

I could here give another Rule for this purpoſe, but it not being ſo intelligible and uſeful in all Caſes, the inſerting of it may only ſerve to hinder the Learner in his Progreſs: I therefore omit it.

A few Examples will enable the Reader to apply the Rules above, and fully to underſtand Diviſion of Decimals; as in the 9 Caſes following. But firſt obſerve,

3. The Number of Places in a Decimal ſufficient, when to be multiplied as followeth.

In the Decimal of l. 1 Sterling.		*In the Decimal of* 1 *Shilling.*		*In the Decimal of* lb 1 *Troy.*		*In the Decimal of* lb *Averdu.*		*In the Decimal of* 1 *Barrel Beer.*		
Places ſufficient.	*When to be multiplied by theſe or under.*	*Places ſufficient.*	*When to be multiplied by theſe or under.*	*Places ſufficient*	*When to be multiplied by theſe or under.*	*Places ſufficient.*	*When to be multiplied by theſe or under.*	*Places ſufficient.*	*When to be multiplied by theſe or under.*	
9	1000000	9	20000000	9	190000	9	4000000	9	3800000	*Without loſing a Unit of the leaſt Denomination.* Vid. *alſo Caſe* 5. *above.*
8	100000	8	2000000	8	19000	8	400000	8	380000	
7	10000	7	200000	7	1900	7	40000	7	38000	
6	1000	6	20000	6	190	6	4000	6	3800	
5	100	5	2000	5	19	5	400	5	380	
4	10	4	200	4	1.9	4	40	4	38	
3	1.0	3	20			3	4.0	3	3.8	
		2	2.0							

I have inſerted this Table, that you may not run your Decimal to more places than are abſolutely neceſſary.

To apply the firſt and ſecond Rules above.

Example 1. To divide a mixt Number by a mixt, as 237.3469 1084 by 25.324.

25.324) 237.3469 1084 (9.37241.

94309

183371

61030

103828

25324

0

Examp. 2. To divide 11.50554 by 932, ſo that ſix places Decimal may be in the Product.

932) 11.505540 (.012345 = Quote as *per* the 2 Rules above, adding 1 Cypher to the Dividend.

2185

3215

4194

4660

0

Example 3. To divide .1234567 by .321, a Decimal by a Decimal, and to have seven Decimal places in the Quote.

Here, according to the first Rule above, to have 7 places in the Quotient, I must have 10 in the Dividend, which I make the other places up by adding three Cyphers.

2. According to the 2d Rule, I point off 7 Decimal places in the Quote, because that is the difference between those places in the Dividend and Divisor.

.321) .1234567000 (.3846003
2715
1476
1927
1000
37

Example 4. To divide a Decimal by a whole Number, as .463 by 3214, and to have 8 Decimal Places in the Quotient.

3214) .46300000 (.00014405
14160
13040
18400
2130

Example 5. To divide a whole by a mixt Number, so as to have 9 places in the Decimal Part of the Quote; as 9 by 3.214.

3.214) 9.000000000000 (2.800248911 =the Quote
25720
8000
15720
28640
29280
3550
3260
46 rests.

Exam-

Example 6. To divide a whole Number by a whole, and to have 10 Decimal Places in the Quotient; as 5 by 365.

365) 5.0000000000 (.0136986301
1350
2550
3600
3150
2300
1100
0500
135

Example 7. To divide a mixt Number by a Decimal; as 1.25999 by .002: and to to have 4 Decimal Places in the Quotient.

.002) 1.259990 0 (629.9950

Half the Dividend gives the Figures of the Quote.

Example 8. To divide a whole Number by a Decimal, as 999 by .00013; and to have only 3 Decimal places in the Quote.

Example 9. To divide a Decimal by a mixt Number, as .5 by 7.5; and to have 2 places Decimal in the Quotient: which are sufficient in case of Decimals of a Gallon, and the Quotient not required to be multiplied by any thing; as follows.

.00013) 999.00000000 (7684615.384
89
110
60
80
20
70
50
110
60
8 refts.

7.5) .500 (.06 r
50

These are all the Varieties that can happen in Division of Decimals: And the Exemplification of the two Rules first above, appear at one View thus.

The 9 Cases.	*Divisors.*	*Dividends given.*	*Cyphers added as per Rule 1. above.*	*Quotients; having Decimals, as per Rule 2.*
1	25.324	237.34691084		9.37241.
2	932.	11.50554	0	.012345.
3	.321	.1234567	000	.3846003
4	3214	.463	00000	.00014405
5	3.214	9.	000000000000	2.800248911
6	365.	5.	0000000000	.013698630 1
7	.002	1.25999	00	629.9950
8	.00013	999.	00000000	7684615.384
9	7.5	.5	00	.06r 1

Of Decimal by way of Vulgar Fractions.

To work any Question so as to give the Answer exquisitely (without omitting any thing) by Decimals as well as by Vulgar Fractions. [Note, *This is my own Thought, as the rest of what is new in Decimals is.*]

It has been one great Objection against Decimals, that where the Decimals in Quotients happen not to be compleat, but infinite, the Answer cannot be exhibited so accurately, as to be truly said to be the whole Truth: But this is easily solved, by considering the Nature of the Remainers in the dividing and making a Fraction of that and the Divisor.

So that the Proof of this depends both upon Vulgar and Decimal Fractions worked promiscuously, or of Decimal worked by way of Vulgar Fractions.

To instance in Example 3. foregoing, the true Quote (as in the Margin below is proved) is = .3846003 $\cdot\circ\circ\bullet\bullet\bullet\circ\circ \frac{\circ 3 7}{3 2 1}$: For the 37 is what remained in dividing the last part of the Dividend; and besides the 2 places next the right hand thereof, there being 8 more Decimal places towards the left hand, therefore so many Cyphers are in the Numerator of that part expressed by way of Vulgar Fractions, which must always be observed.

The Truth of this appears by reducing this mixt Number to one Fraction: for the Product of .3846003 multiplied by the Denominator .321, produceth .1234566963; to which adding the Numerator, the Sum is .1234567: which placed over the Denomina-

tor

tor .321, gives the Fraction answerable to the first proposed Question in Example 3.

And by the same Rules the Quote or Answer *in the 4th Example* is to be expressed thus .00014405 $\cdot\frac{000\bullet 0233}{5214}$. Which if reduced into a single Fraction, as before, is $\frac{\cdot 463}{5214}$.

So likewise the accurate Answer or Quotient *in Example* 5. is .280024891 1 $\cdot\frac{0000\bullet 0000}{3}\cdot\frac{046}{214}$, reducible to $\frac{\cdot}{3}\cdot\frac{9}{214}$.

In Example 6. the exact Quote is consequently = .013698630 1 .$\bullet\bullet\bullet\bullet\bullet\bullet\bullet 0\frac{135}{36}$: or by the Rules above $\frac{\cdot}{3}\cdot\frac{5}{6}$ in a simple Fraction for Proof.

In Example 8. The precise Quotient is 7684615.384$\cdot\cdot\cdot\frac{\bullet\bullet\bullet\bullet\bullet 8}{\bullet\bullet\bullet 13}$. Or by reducing the 2 sorts of Fractions to one Fraction, the whole will stand thus; 7684615:$\frac{00005}{00013}$ without any loss: which (for Proof) is reducible to .$\frac{999}{\bullet\bullet\bullet 13}$.

Lastly, *In Example* 9. The true Quote is .0666*r* 1, or rather .06$\cdot\frac{0}{7}\cdot\frac{5}{5}$; whose Value (if the Fraction of a Pound) is known to be 16*d*. We will try if it will prove so by the Method shew'd above.

The 50 remaining (by the Rule relating to the third Example) is .050, there being 1 more place Decimal towards the left hand besides the 2 places in the Remainer: so that the .06$\cdot\frac{0}{7}\cdot\frac{5}{5}$ includes the whole Answer without any Loss, as *per* the Work in the Margin; and is reduced to $\frac{\cdot}{7}:\frac{5}{5}$, whose Value, as *per* Vulgar Fractions, having respect to the Points, as in Multiplication and Division of Decimals, is 1*s*. 4*d*.

3. *Note*, That to divide any Decimal, Whole, or Mixt Number by a Unit with Cyphers, is only to remove the Point so many places towards the left hand, as there are Cyphers. Thus,

.3846003
.321

add { .1234566963
{ .0000000037

Sum .1234567000
or $\cdot\frac{1234}{\cdot}\frac{567}{53}\frac{7}{21}$ for Proof.

The new Fract. $= \frac{\cdot 5}{7\cdot 5}$ *l.*

The Value is thus found, as of Vulgar;

.5
. 20

7.5)10.0(1 *s.*

2.5
1 2

7.5)30.0(4 Pence.

0

7·5 } mult.
.06 }

·450 } add.
.05 }

.500 Sum.

If 10 divide 98765.4 the Quote is 9876.54
100 divide it, —— 987.654
1000 —— 98.7654
10000 —— 9.87654
100000 —— .987654
1000000 —— .0987654

4. Or if 60 divide 98765.4 the Quote is 1646.09

600 —— 164.609
6000 —— 16.4609
60000 —— 1.64609
600000 —— .164609

Dividing only by the 6, and cutting off ſo many from the Quote (beſides the Decimal Places in the Dividend) as there are Cyphers in the Diviſor.

5. *That Diviſion of Decimals is performed as that of Vulgar Fractions.* As if $\frac{1234567}{1000}$ be divided by $\frac{321}{1000}$, the Quote will be $\frac{1234567000}{321000000}$ equal to the Decimal Quote .3846003, by dividing the Numerator by 321, and cutting as many from the Quotient as there are Cyphers to the right of 321, as *per* Margin.

$\frac{321}{1000})\frac{1234567}{1000000}(\frac{1234567000}{321000000}$

321) 1234567000 (.3846003

SECT. VII. *The Rule of Proportion by Decimals.*

THIS being the ſame as in whole Numbers, obſerving Multiplication and Diviſion of Decimals for the proper Rules of pointing out the Products and Quotients; I need only give one Example.

What is the Intereſt of *l.* 325 : 15 : — for a Year, at 4 *l.* 10 *s. per Cent. per Annum?*

The Anſwer is *l.*14.65775, as *per* Compend. 6, *&c.* or *l.* 14 : 13 : 1 $\frac{3}{4}$, by the 6th Rule of the Valuation of Decimals.

100. 4.5 :: 325.75
4.5

l. 14.65775 Anſwer.

And this puts me in mind of

SECT.

Sect. VIII. *The Use of Decimals in the calculating Interest Simple and Compound.*

I. SIMPLE Interest is the Interest of the Principal only, for the time proposed.

II. The true Discount of Money is in proportion to its Principal: As 5 is to 105 (at 5 *per Cent.*) or as 6 to 106 at 6 *per Cent. &c.* So that the Discount of any Sum for any time is less than the Interest for that time, and consequently the Discount of any Sum at any rate is found for a Year by this Proportion:

As 100 and the Rate: is to the Rate: so any Sum to the Discount for the same time.)

III. Compound Interest is the Interest of the Principal and of the Interest put together, (the latter not being paid when due, but becomes Principal.)

1. *As to Simple Interest*, there are Laws in most Countries to ascertain it, that no one shall take more, under the penalty of forfeiting the Principal, *&c.* as now ours is 5 *per Cent.* for what is lent for the future.

To find the Simple Interest of any Sum for a Year.

(1.) What is the Interest of *l.*364 : 17 : $5\frac{1}{4}$ at 5 *per Cent*?

As 100. 5 :: 364 : 17 : $5\frac{1}{4}$

Answ. *l.* 18 : 4 : $10\frac{1}{2}$

Multiply the whole by 5, and divide by 100 continually, as you see here.

5

*l.*18.24 : 7 : $2\frac{1}{4}$

20

s. 4.87

12

d. 10.46

4

qr. 1.85

(2.) But if the Shillings, *&c.* are easily by Inspection reducible to a compleat Decimal, the best way is to do such Questions decimally.

Example.

Example. What is the Interest of *l.* 364 : 18 : — for a Year, at 5 *per Cent?*

See the Operation in the Margin, the Answer being *l.* 18 : 4 : 10¾.

100. 5 :: 364.9
5

18.245 Answer.

(3.) If the Interest of any Sum be required for any Number of Days (or Part of a Year) 'tis best done by Decimals.

Example. Suppose the Interest of the Principal in the last Case is required only for 145 Days:

1st say, 100. 5 :: 364.9
5

the Interest = 18.245 for 1 Year.

Days. *l.* *Days.*
2dly, 365. 18.245 :: 145
145

l.
365) 2645.525 (7.248$^{\frac{9}{5}\frac{5}{5}}$ = Answer.
905
1752
2925
5

2. And consequently the Interest of the said *l.* 364 : 17 : 11¼ for 314 Days is found, reducing the odd Money to Decimals, as *per* the second Rule in Reduction, which is *l.*.871875 : Therefore

100. 5 :: 364.871875. 18.2435937 = Int. for a Year.
Days. *l.* *Days.* *l.*
365. 18.2435937 :: 314. 15.694 = the Answer.

3. By the same Rule with the two last, the Interest of *l.* 1 for one Day at any rate is found, and they are Multipliers for finding the Simple Interest of any Number of Pounds for any Days:

For 100. 5 :: 1. .05
And as 365. .05 :: 1. .000136, *&c.*

Thus

Thus 1 *l.* for 1 Day at 4 *per Cent.* = .0001095890 4
5 *per Cent.* is .0001369863
at 6 *per Cent.* = .0001643835 6
at 7 *per Cent.* = .0001917808 2
8 *per Cent.* = .0002191780 8
} *Factors for finding the Interest for Days.*

These Numbers may be thus used: Suppose I would know the Interest of *l.* 400 for 297 Days at 5 *per Cent.* I multiply .0001369863 by 297, and the Product is the Interest of *l.* 1 for 297 Days; which Product multiplied by *l.* 400, gives the Interest of *l.* 400 for 297 Days = the Answer, *l.* 16 : 5 : 5 $\frac{3}{4}$.

4. If you divide 100 by the Rate of Interest, it gives the Years Purchase in Fee of Lands Value in many places. And consequently if 100 be divided by the Years Purchase that the generality of Lands are valued at, the Quote gives the proportionable Rate of Interest. Which is a Rule that many go by, to know whether Interest is too high or low, by observing how Lands sell: It happens right with us at present, for 5 *per Cent.* agrees with 20 Years Purchase of Land.

5. It is easy to find the Simple Interest of any Sum for any Number of Years, as suppose *l.* 100 : 15, for 7 Years at 5 *per Cent.* say

100. 5 :: 100.75. 5.0375 = Int. for 1 Year.
7 mult.

35.2625 = Answer, or *l.* 35 : 5 : 3

6. And consequently for the Interest of a Sum under *l.* 1, as 15 *s.*

100. 5 :: .75. .0375 for 1 Year; or .2625 *l.* for 7 Years.

7. Finding the Interest of *l.* 732 for 5 Years to be *l.* 183, what is that *per Cent. per Ann.*? I first divide *l.* 183 by 5 Years, and the Quote is *l.* 36.6. Then say, As 732. 36.6. :: 100. 5 *per Cent.* Answer.

Here followeth Tables of Interest, Simple, Compound, and Discount, with their Calculation and Use.

A TABLE *of* SIMPLE INTEREST *at 4 per Cent.*

Principal.	1 *Day.* s. d. q.	2 *Days.* s. d. q.	3 *Days.* s. d. q.	4 *Days.* s. d. q.	5 *Days.* s. d. q.	6 *Days.* s. d. q.	7 *Days.* s. d. q.	8 *Days.* s. d. q.
1	*l.*.000109589						1	1
2			1	1	1	1	1	2
3		1	1	1	1	2	2	2
4		1	1	2	2	3	3	3
5	1	1	2	2	3	3	1 0	1 0
6	1	2	2	3	3	1 0	1 0	1 1
7	1	2	2	3	1 0	1 0	1 1	1 2
8	1	2	2	3	1 0	1 1	1 2	1 3
9	1	2	3	1 0	1 1	1 2	1 3	2 0
10	1	2	3	1 0	1 1	1 2	1 3	2 1
20	2	1 0	1 2	2 0	2 2	3 1	3 3	4 1
30	3	1 2	2 1	3 1	4 0	4 3	5 2	6 1
40	1 0	2 0	3 1	4 1	5 1	6 1	7 1	8 2
50	1 1	2 2	4 0	5 1	6 2	7 3	2 1	10 2
60	1 2	3 1	4 3	6 1	7 3	9 2	11 0	1 — 2
70	1 3	3 3	5 2	7 1	9 1	11 0	1 — 3	1 2 3
80	2 0	4 1	6 1	8 2	10 2	1 — 2	1 2 3	1 5 0
90	2 1	4 3	7 0	9 2	1 — 0	1 2 1	1 4 2	1 7 0
100	2 2	5 1	7 3	10 2	1 1 0	1 3 3	1 6 2	1 9 0
200	5 1	10 2	1 3 3	1 9 0	2 2 1	2 7 2	3 — 3	3 6 0
300	7 3	1 3 3	1 11 3	2 7 2	3 3 2	3 11 2	4 7 1	5 3 1
400	10 2	1 9 0	2 7 2	3 6 0	4 4 2	5 3 1	6 1 2	7 — 0
500	1 1 0	2 2 1	3 3 2	4 4 3	5 5 3	6 7 0	7 8 0	8 9 1
600	1 3 3	2 7 2	3 11 2	5 3 1	6 7 0	7 10 3	9 2 2	10 6 1
700	1 6 1	3 — 3	4 7 1	6 1 2	7 8 0	9 2 2	10 8 3	12 3 1
800	1 9 0	3 6 0	5 3 1	7 — 0	8 9 1	10 6 1	12 3 1	14 — 1
900	1 11 3	3 11 2	5 11 0	7 10 3	9 10 2	11 10 0	13 9 3	15 9 2
1000	2 2 1	4 4 2	6 7 0	8 9 1	10 11 2	13 1 3	15 4 1	17 6 2
ditto	*L*.109589	.219178	.328767	.438356	.547945	.657534	.767123	.876110

SIMPLE INTEREST at 4 *per Cent.*

Principal	9 Days.			10 Days.			20 Days.			30 Days.			40 Days.			50 Days.			60 Days.		
	l.	s.	d. q.	l.	s.	d. q.	l.	s.	d. q.	l.	s.	d. q.	l.	s.	d. q.	l.	s.	d. q.	l.	s.	d. q.
1			1			1			2			3		1	0			1 1			1 2
2			2			2		1	0		1	2		2	0			2 2			3 1
3			3			3		1	2		2	1		3	1			4 0			4 3
4		1	0		1	0		2	1		3	1		4	1			5 1			6 1
5		1	1		1	1		2	3		4	0		5	1			6 2			7 3
6		1	2		1	2		3	1		4	3		6	1			7 3			9 2
7		1	3		1	3		3	3		5	2		7	1			9 1			11 1
8		2	0		2	1		4	1		6	1		8	2			10 2		1	— 2
9		2	1		2	2		4	3		7	0		9	2		1	— 0		1	2 1
10		2	2		2	3		5	1		7	3		10	2		1	1 0		1	3 3
20		4	3		5	1		10	2	1	3	3	1	9	0		2	2 1		2	7 2
30		7	0		7	3	1	3	3	1	11	3	2	7	2		3	3 2		3	11 2
40		9	2		10	2	1	9	0	2	7	2	3	6	0		4	4 3		5	3 1
50		1	— 0		1	1 0	2	2	1	3	3	2	4	4	3		5	5 3		6	7 0
60		1	2 1		1	3 3	2	7	2	3	11	2	5	3	1		6	7 0		7	10 3
70		1	4 2		1	6 2	3	—	3	4	7	1	6	1	2		7	8 0		9	2 2
80		1	7 0		1	9 0	3	6	0	5	3	1	7	—	0		8	9 1		10	6 1
90		1	9 1		1	11 3	3	11	2	5	11	0	7	10	3		9	10 2		11	10 0
100		1	11 3		2	2 1	4	4	3	6	7	0	8	9	1		10	11 2		13	1 3
200	3	11	2		4	4 3	8	9	1	13	1	3	17	6	2	1	1	11 0	1	6	3 3
300	5	11	0		6	7 0	13	1	3	19	8	3	1	6	3 3	1	12	10 2	1	19	5 2
400	7	10	3		8	9 1	17	6	2	1	6	3 3	1	15	— 3	2	3	10 0	2	12	7 1
500	9	10	2		10	11 2	1	1	11 0	1	12	10 2	2	3	10 0	2	14	9 2	3	5	9 0
600	11	10	0		13	1 3	1	6	3 3	1	19	5 2	2	12	7 1	3	5	9 0	3	18	11 0
700	13	9	3		15	4 0	1	10	8 1	2	6	— 1	3	1	4 2	3	16	8 2	4	12	— 2
800	15	9	1		17	6 2	1	15	— 3	2	12	7 1	3	10	1 2	4	7	8 0	5	5	2 2
900	17	9	0		19	8 3	1	19	5 2	2	19	2 0	3	18	11 0	4	18	7 2	5	18	4 1
1000	19	8	3	1	1	11 0	2	3	10 0	3	5	9 0	4	7	8 0	5	9	7 0	6	11	6 0
ditto	1.98	63	02	1.09	58	9	2.19	17	81	3.28	76	71	4.38	35	62	5.47	94	52	6.57	53	42

SIMPLE INTEREST *at* 4 *per Cent.*

Principal.	70 *Days.* l. s. d. q.	80 *Days.* l. s. d. q.	90 *Days.* l. s. d. q.	100 *Days.* l. s. d. q.	110 *Days.* l. s. d. q.	120 *Days.* l. s. d. q.
1	1 3	2 0	2 1	2 2	3 0	3 1
2	3 3	4 1	4 3	5 1	5 3	6 1
3	5 2	6 1	7 0	7 3	8 3	9 3
4	7 1	8 2	9 2	10 2	11 3	1 — 2
5	9 1	10 2	1 — 0	1 1 1	1 2 2	1 3 3
6	11 0	1 — 2	1 2 1	1 3 3	1 5 2	1 7 0
7	1 — 3	1 2 3	1 4 3	1 6 2	1 8 1	1 10 0
8	1 2 3	1 5 0	1 7 0	1 9 0	1 11 1	2 1 1
9	1 4 3	1 7 0	1 9 1	1 11 3	2 2 0	2 4 2
10	1 6 2	1 9 0	1 11 3	2 — 0	2 5 0	2 7 2
20	3 — 3	3 6 0	3 11 2	4 4 3	4 10 0	5 3 1
30	4 7 1	5 3 1	5 11 0	6 17 0	7 2 3	7 10 3
40	6 1 2	7 — 0	7 11 0	8 19 1	9 7 3	10 6 1
50	7 8 0	8 9 1	9 10 2	10 11 2	12 — 2	13 1 3
60	9 2 2	10 6 1	11 10 0	13 3 3	14 5 2	15 9 1
70	10 8 3	12 3 1	13 9 3	15 4 1	16 10 2	18 4 3
80	12 3 1	14 — 1	15 9 1	17 6 1	19 3 2	1 1 — 1
90	13 9 3	15 9 2	17 9 0	19 8 3	1 1 8 1	1 3 8 0
100	15 4 1	17 6 2	19 8 3	1 1 11 0	1 4 1 1	1 6 3 1
200	1 10 8 1	1 15 — 3	1 19 5 1	2 3 10 0	2 8 2 2	2 12 7 2
300	2 6 — 1	2 12 7 1	2 19 2 1	3 5 9 0	3 12 4 0	3 18 11 0
400	3 1 4 2	3 10 1 2	3 18 11 0	4 7 8 0	4 16 5 1	5 5 2 1
500	3 16 8 2	4 7 8 0	4 18 7 2	5 9 7 0	6 — 6 2	6 11 6 2
600	4 12 — 3	5 5 2 2	5 18 4 1	6 11 6 0	7 4 7 3	7 17 9 3
700	5 7 4 3	6 2 8 3	6 18 — 0	7 13 5 0	8 8 9 1	9 4 1 0
800	6 2 8 3	7 — 3 1	7 17 9 3	8 15 4 0	9 12 10 2	10 10 5 1
900	6 18 1 0	7 17 9 3	8 17 6 2	9 17 3 0	10 16 11 3	11 16 8 3
1000	7 13 5 0	8 15 4 1	9 17 3 1	10 19 2 1	12 1 1 0	13 3 — 0
ditto	17.671233	8.767123	9.863014	10.958904	12.054794	13.150685

SIMPLE INTEREST *at* 4 *per Cent.*

Principal.	130 *Days.*				140 *Days.*				150 *Days.*				160 *Days.*				170 *Days.*				180 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			3	2			3	3			4	0			4	1			4	2			4	3
2			6	3			7	1			7	3			8	2			9	0			9	2
3			10	1			11	0		1	0	0		1	0	2		1	1	2		1	2	1
4		1	1	3		1	2	3		1	4	0		1	5	0		1	5	3		1	7	0
5		1	5	1		1	6	2		1	7	3		1	9	0		1	10	1		1	11	3
6		1	8	2		1	10	1		1	11	3		2	1	1		2	2	3		2	4	2
7		2	0	0		2	1	3		2	3	3		2	5	2		2	7	1		2	9	1
8		2	3	1		2	5	2		2	7	2		2	9	3		2	11	3		3	1	3
9		2	6	3		2	9	1		2	11	2		3	1	3		3	4	1		3	6	2
10		2	10	1		3	0	3		3	3	2		3	6	0		3	8	3		3	11	2
20		5	8	1		6	1	2		6	7	0		7	0	0		7	5	2		7	10	3
30		8	6	2		9	2	2		9	10	2		10	6	1		11	2	0		11	10	0
40		11	4	3		12	3	1		13	1	3		14	0	1		14	11	0		15	9	2
50		14	3	0		15	4	1		16	5	1		17	6	2		18	7	2		19	8	3
60		17	1	0		18	5	0		19	8	3	1	1	0	2	1	2	4	1	1	3	8	0
70		19	11	2	1	1	5	3	1	3	0	0	1	4	6	1	1	6	1	0	1	7	7	1
80	1	2	9	2	1	4	6	2	1	6	3	3	1	8	0	3	1	9	9	3	1	11	6	3
90	1	5	7	3	1	7	7	1	1	9	7	0	1	11	6	3	1	13	6	2	1	15	6	0
100	1	8	6	0	1	10	8	1	1	12	10	2	1	15	0	3	1	17	3	1	1	19	5	2
200	2	17	0	0	3	1	4	2	3	5	9	0	3	10	1	2	3	14	6	1	3	18	11	0
300	4	5	5	3	4	12	0	2	4	18	7	2	5	5	2	2	5	11	9	2	5	18	4	1
400	5	13	11	3	6	2	8	3	6	11	6	0	7	0	3	1	7	9	0	2	7	17	9	3
500	7	2	5	2	7	13	5	0	8	4	4	3	8	15	4	1	9	6	3	3	9	17	3	1
600	8	10	11	2	9	4	1	1	9	17	3	1	10	10	5	0	11	3	6	3	11	16	8	2
700	9	19	5	2	10	14	9	2	11	10	1	2	12	5	5	3	13	0	10	0	13	16	2	0
800	11	7	11	2	12	5	5	3	13	3	0	0	14	0	6	2	14	18	1	0	15	15	6	3
900	12	16	5	1	13	16	2	0	14	15	10	3	15	15	7	1	16	15	4	1	17	15	0	3
1000	14	4	11	1	15	6	10	1	16	8	9	1	17	10	8	1	18	12	7	1	19	14	6	1
ditto	*l.*	14	24	6574		15	34	2464		16	43	8354		17	53	4244		18	63	0134		19	72	6024

SIMPLE INTEREST *at* 4 *per Cent.*

Principal	190 *Days.*				200 *Days.*				210 *Days.*				220 *Days.*				230 *Days.*				240 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			5	0			5	1			5	2			5	3			6	0			6	1
2			10	0			10	2			11	0			11	3		1	0	0		1	0	2
3		1	3	0		1	3	3		1	4	3		1	5	2		1	6	0		1	7	0
4		1	8	0		1	9	0		1	10	0		1	11	1		2	0	0		2	1	1
5		2	1	0		2	2	1		2	3	3		2	5	0		2	6	1		2	7	2
6		2	6	0		2	7	2		2	9	1		2	10	3		3	0	1		3	1	3
7		2	11	0		3	0	3		3	2	3		3	4	2		3	6	1		3	8	1
8		3	4	0		3	6	0		3	8	1		3	10	1		4	0	1		4	2	2
9		3	9	0		3	11	2		4	1	3		4	4	0		4	6	2		4	8	3
10		4	2	0		4	4	3		4	7	1		4	10	0		5	0	2		5	3	1
20		8	4	0		8	9	1		9	2	2		9	7	3		10	1	0		10	6	1
30		12	6	0		13	1	3		13	9	2		14	5	3		15	1	2		15	9	1
40		16	7	3		17	6	2		18	5	0		19	3	2	1	0	2	0	1	1	0	2
50	1	0	10	0	1	1	11	0	1	3	0	0	1	4	1	1	1	5	2	2	1	6	3	3
60	1	5	0	0	1	6	3	3	1	7	7	1	1	8	11	1	1	10	3	0	1	11	6	3
70	1	9	1	3	1	10	8	1	1	12	2	2	1	13	9	0	1	15	3	2	1	16	10	0
80	1	13	4	3	1	15	0	3	1	16	10	0	1	18	7	0	2	0	4	0	2	2	1	0
90	1	17	5	3	1	19	5	2	2	1	5	0	2	3	4	3	2	5	4	2	2	7	4	1
100	2	1	7	3	2	3	10	0	2	6	0	1	2	8	2	2	2	10	5	0	2	12	7	1
200	4	3	3	2	4	7	8	0	4	12	0	2	4	16	5	1	5	0	10	0	5	5	2	2
300	6	4	11	1	6	11	6	0	6	18	1	0	7	4	7	3	7	11	2	3	7	17	9	3
400	8	6	6	3	8	15	4	0	9	4	1	1	9	12	10	2	10	1	7	3	10	10	5	0
500	10	8	2	2	10	19	2	0	11	10	1	2	12	1	1	0	12	12	0	3	13	3	0	0
600	12	9	10	2	13	3	0	0	13	16	2	0	14	9	3	3	15	2	5	2	15	15	7	1
700	14	11	6	0	15	6	10	1	16	2	2	1	16	17	6	2	17	12	10	2	18	8	2	2
800	16	13	1	3	17	10	8	1	18	8	2	2	19	5	9	0	20	3	3	2	21	0	10	0
900	18	14	9	2	19	14	6	1	20	14	3	0	21	13	11	3	22	13	8	1	23	13	5	0
1000	20	16	5	1	21	18	4	1	23	0	3	1	24	2	2	1	25	4	1	1	26	6	0	1
ditto	*l.* 20.821914				21.917805				23.013695				24.109585				25.205476				26.301366			

SIMPLE INTEREST at 4 *per Cent.*

Principal	250 *Days.*				260 *Days.*				270 *Days.*				280 *Days.*				290 *Days.*				300 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			6	2			6	3			7	0			7	1			7	2			7	3
2		1	1	0		1	1	2		1	2	1		1	2	3		1	3	1		1	3	3
3		1	7	3		1	8	2		1	9	1		1	10	0		1	11	0		1	11	3
4		2	2	1		2	3	1		2	4	2		2	5	2		2	6	2		2	7	2
5		2	8	3		2	10	1		2	11	2		3	0	3		3	2	0		3	3	2
6		3	3	2		3	5	0		3	6	2		3	8	1		3	9	3		3	11	2
7		3	10	0		4	0	0		4	1	3		4	3	2		4	5	1		4	7	1
8		4	4	2		4	6	3		4	8	3		4	11	0		5	1	0		5	3	1
9		4	11	1		5	1	2		5	4	0		5	6	1		5	8	3		5	11	0
10		5	3	1		5	8	1		5	11	0		6	1	2		6	4	1		6	7	0
20		10	11	2		11	4	3		11	10	0		12	3	1		12	8	2		13	1	3
30		16	5	1		17	1	0		17	9	0		18	5	0		19	0	3		19	8	3
40	1	1	11	0	1	2	9	2	1	3	8	0	1	4	6	2	1	5	5	0	1	6	3	3
50	1	7	4	3	1	8	6	0	1	9	7	0	1	10	8	1	1	11	9	2	1	12	10	2
60	1	12	10	3	1	14	2	1	1	15	6	0	1	16	10	0	1	18	1	2	1	19	5	2
70	1	18	4	1	1	19	10	3	2	1	5	0	2	2	11	2	2	4	6	0	2	6	0	1
80	2	3	10	0	2	5	7	0	2	7	4	0	2	9	1	1	2	10	10	1	2	12	7	1
90	2	9	3	3	2	11	3	2	2	13	3	1	2	15	2	3	2	17	2	2	2	19	2	0
100	2	14	9	2	2	17	0	0	2	19	2	1	3	1	4	2	3	3	6	3	3	5	9	0
200	5	9	7	0	5	13	11	3	5	18	4	1	6	2	8	3	6	7	1	2	6	11	6	0
300	8	4	4	2	8	10	11	2	8	17	6	2	9	4	1	1	9	10	8	1	9	17	3	1
400	10	19	2	0	11	7	11	2	11	16	8	2	12	5	5	3	12	14	3	0	13	3	0	0
500	13	13	11	3	14	4	11	1	14	15	10	3	15	6	10	1	15	17	9	3	16	8	9	1
600	16	8	9	1	17	1	11	0	17	15	0	3	18	8	2	2	19	1	4	2	19	14	6	1
700	19	3	6	3	19	18	11	0	20	14	3	0	21	9	7	0	22	4	11	1	23	0	3	1
800	21	18	4	1	22	15	10	3	23	13	5	0	24	10	11	2	25	8	6	0	26	6	0	1
900	24	13	1	3	25	12	10	2	26	12	7	1	27	12	4	0	28	12	0	3	29	11	9	2
1000	27	7	11	2	28	9	10	1	29	11	9	2	30	13	8	1	31	15	7	1	32	17	6	2
ditto	*l.* 27.397256				28.493151				29.589041				30.684931				31.780821				32.876712			

SIMPLE INTEREST *at* 4 *per Cent.*

Principal.	310 *Days.*				320 *Days.*				330 *Days.*				340 *Days.*				350 *Days.*				360 *Days.*				365 Days or 1 Year			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			8	1			8	2			8	3			9	0			9	1			9	2			9	3
2		1	4	1		1	5	0		1	5	2		1	6	0		1	6	2		1	7	0		1	7	1
3		2	0	2		2	1	1		2	2	0		2	2	3		2	3	3		2	4	2		2	5	0
4		2	8	2		2	9	3		2	10	3		2	11	3		3	0	3		3	1	3		3	2	1
5		3	4	3		3	6	0		3	7	1		3	8	3		3	10	0		3	11	2		4	0	0
6		4	0	3		4	2	2		4	4	0		4	5	3		4	7	1		4	8	3		4	9	1
7		4	9	0		4	11	0		5	0	3		5	2	2		5	4	2		5	6	1		5	7	1
8		5	5	1		5	7	1		5	9	2		5	11	2		6	1	2		6	3	3		6	5	0
9		6	1	1		6	3	3		6	6	0		6	8	2		6	11	0		7	1	1		7	2	2
10		6	9	2		7	0	0		7	2	3		7	5	2		7	8	0		7	10	3		8		
20		13	7	0		14	0	1		14	5	2		14	11	0		15	4	0		15	9	2		16		
30	1	0	4	3	1	1	0	2	1	1	8	1	1	2	4	1	1	3	0	0	1	3	8	0	1	4		
40	1	7	2	0	1	8	0	3	1	8	11	1	1	5	9	3	1	10	8	1	1	11	6	3	1	12		
50	1	13	11	3	1	15	0	3	1	16	2	0	1	17	3	1	1	18	4	1	1	19	5	2	2	0		
60	2	0	9	1	2	2	1	0	2	3	4	3	2	4	8	2	2	6	0	1	2	7	4	1	2	8		
70	2	7	6	3	2	9	1	1	2	10	7	2	2	12	2	0	2	13	8	1	2	15	2	3	2	16		
80	2	14	4	1	2	16	1	1	2	17	10	2	2	19	7	1	3	1	4	2	3	3	1	2	3	4		
90	3	1	1	3	3	3	1	2	3	5	1	1	3	7	0	3	3	9	0	2	3	11	0	0	3	12		
100	3	7	11	2	3	10	1	3	3	12	4	0	3	14	6	1	3	16	8	2	3	18	11	0	4			
200	6	15	10	3	7	0	3	1	7	4	7	3	7	9	0	2	7	13	5	0	7	17	9	3	8			
300	10	3	10	0	10	10	5	0	10	16	11	3	11	3	6	3	11	10	1	2	11	16	8	2	12			
400	13	11	9	2	14	0	6	2	14	9	4	3	14	18	1	0	15	6	10	1	15	15	7	1	16			
500	16	19	8	3	17	10	8	1	18	1	7	3	18	12	7	1	19	3	6	3	19	14	6	1	20			
600	20	7	8	0	21	0	10	0	21	13	11	3	22	7	1	2	23	0	3	1	23	13	5	0	24			
700	23	15	7	1	24	10	11	2	25	6	3	3	26	1	7	3	26	17	0	0	27	12	4	0	28			
800	27	3	6	3	28	1	1	1	28	18	7	2	29	16	2	0	30	13	8	1	31	11	2	3	32			
900	30	11	6	0	31	11	2	3	32	10	11	2	33	10	8	1	34	10	5	0	35	10	1	3	36			
1000	33	19	5	2	35	1	4	2	36	3	3	2	37	5	2	2	38	7	1	2	39	9	0	2	40			
ditto	*l.* 33.9726				35.06849				36.16438				37.26027				38.35616				39.45206				40.0			

A TABLE *of* SIMPLE INTEREST *at 5 per Cent.*

Principal.	1 *Day.*			2 *Days.*			3 *Days.*			4 *Days.*			5 *Days.*			6 *Days.*			7 *Days.*			8 *Days.*		
l.	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1	*l.*00013699																		1						1
2										1			1			1			2						2
3							1			1			2			2			3						3
4						1	1			2			2			3			1	0					1	0
5						1	2			3			3			1	0		1	0					1	1
6						1	2			3			1	0		1	1		1	1					1	2
7						2	3			1	0		1	0		1	1		1	2					1	3
8			1			2	3			1	0		1	1		1	2		1	3			2	0		
9			1			2	3			1	1		1	2		1	3		2	0			2	1		
10			1			2	1	0		1	1		1	2		2	0		2	1			2	2		
20			2		1	1	2	0		2	2		3	1		4	0		4	2			5	0		
30		1	0		2	0	3	0		4	0		5	0		5	3		6	3			7	3		
40		1	1		2	2	4	0		5	1		6	0		7	3		9	1			10	2		
50		1	2		3	1	5	0		6	2		8	1		10	0		11	2		1	1	0		
60		2	0		4	0	5	3		7	3		10	0		11	3		1	1	3		1	3	3	
70		2	1		4	2	6	3		9	1		11	2		1	1	3	1	4	0		1	6	1	
80		2	2		5	1	7	3		10	2		1	1	0	1	3	3	1	6	1		1	9	0	
90		3	0		5	3	8	3		11	3		1	2	3	1	5	3	1	8	3		1	11	2	
100		3	1		6	2	10	0		1	1	0	1	4	2	1	7	3	1	11	0		2	2	1	
200		6	2	1	1	0	1	7	3	2	2	1	2	8	3	3	3	2	3	10	0		4	4	2	
300		10	0	1	7	3	2	5	2	3	3	2	4	1	1	4	11	0	5	9	0		6	6	3	
400	1	1	0	2	2	1	3	3	2	4	4	2	5	5	2	6	6	3	7	8	0		8	9	1	
500	1	4	2	2	8	3	4	1	1	5	5	2	6	10	0	8	2	2	9	7	0		10	11	2	
600	1	7	3	3	3	2	4	11	0	6	6	3	8	2	2	9	10	1	11	6	0		13	1	3	
700	1	11	0	3	10	0	5	9	0	7	8	0	9	7	0	11	6	0	13	5	0		15	4	0	
800	2	2	1	4	4	2	6	6	3	8	9	1	10	11	2	13	2	0	15	4	0		17	6	1	
900	2	5	2	4	11	0	7	4	3	9	10	2	12	4	0	14	9	2	17	3	0		19	8	3	
1000	2	8	3	5	5	3	8	2	2	10	11	2	13	8	1	16	5	1	19	2	0	1	1	11	0	
ditto	*l.* .1369			*l.* .2739			*l.* .4109			*l.* .5479			*l.* .6849			*l.* .8219			*l.* .9589			*l.* 1.0956			

SIMPLE INTEREST at 5 *per Cent.*

Principal	9 *Days.*				10 *Days.*				20 *Days.*				30 *Days.*				40 *Days.*				50 *Days.*				60 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1				1				1				2			1	0			1	1			1	2			2	0
2				2				2			1	1			2	0			2	2			3	1			4	0
3				3			1	0			2	0			3	0			4	0			5	0			5	3
4			1	1			1	1			2	2			4	0			5	1			6	2			7	3
5			1	2			1	2			3	1			5	0			6	2			8	1			9	3
6			1	3			2	0			4	0			5	3			7	3			10	0			11	3
7			2	0			2	1			4	3			6	3			9	1			11	2		1	1	3
8			2	1			2	2			5	1			7	3			10	2		1	1	0		1	3	3
9			2	3			3	0			5	3			8	3			11	3		1	2	3		1	5	3
10			3	0			3	1			6	2		1	0	0		1	1	0		1	4	2		1	7	3
20			5	3			6	2		1	1	0		1	7	3		2	2	1		2	8	3		3	3	2
30			8	3			10	0		1	7	3		2	5	2		3	3	2		4	1	1		4	11	1
40			11	3		1	1	0		2	2	1		3	3	2		4	4	3		5	5	2		6	6	3
50		1	2	3		1	4	2		2	8	3		4	1	1		5	5	3		6	10	0		8	2	2
60		1	5	2		1	7	3		3	3	2		4	11	1		6	6	3		8	2	2		9	10	1
70		1	8	3		1	11	0		3	10	0		5	9	0		7	8	0		9	7	0		11	6	0
80		1	11	2		2	2	1		4	4	3		6	6	3		8	9	1		10	11	2		13	1	3
90		2	2	2		2	5	2		4	11	1		7	4	3		9	10	2		12	4	0		14	9	2
100		2	5	2		2	8	3		5	5	3		8	2	2		10	11	2		13	8	0		16	5	1
200		4	11	0		5	5	2		10	11	2		16	5	1	1	1	11	0	1	7	4	3	1	12	10	2
300		7	4	2		8	2	2		16	5	1	1	4	7	3	1	12	10	2	2	1	1	0	2	9	3	3
400		9	10	1		10	11	2	1	1	11	0	1	12	10	2	2	3	10	0	2	14	9	2	3	5	9	0
500		12	4	0		13	8	1	1	7	4	3	2	1	1	0	2	14	9	2	3	8	5	3	4	2	2	1
600		14	9	2		16	5	0	1	12	10	2	2	9	3	3	3	5	9	0	4	2	2	1	4	18	7	2
700		17	3	0		19	2	0	1	18	4	1	2	17	6	1	3	16	8	2	4	15	10	3	5	15	0	3
800		19	8	3	1	1	11	0	2	3	10	0	3	5	9	0	4	7	8	0	5	9	7	0	6	11	6	0
900	1	2	2	1	1	4	7	3	2	9	3	3	3	13	11	3	4	18	7	2	5	3	3	3	7	7	11	1
1000	1	4	7	3	1	7	4	3	2	14	9	2	4	2	2	1	5	9	7	0	6	16	11	3	8	4	4	2
ditto	*l.* 1.2328				*l.* 1.3698				*l.* 2.7396				*l.* 4.1094				*l.* 5.4792				*l.* 6.8490				*l.* 8.2188			

SIMPLE INTEREST *at 5 per Cent.*

Principal.	70 *Days.*	80 *Days.*	90 *Days.*	100 *Days.*	110 *Days.*	120 *Days.*
l.	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*
1	2 1	2 3	3 0	3 1	3 2	4 0
2	4 2	5 1	5 3	6 2	7 1	7 3
3	6 3	7 3	8 3	9 3	10 3	11 3
4	9 1	10 2	11 3	1 1 0	1 2 2	1 3 3
5	11 2	1 1 0	1 2 3	1 4 2	1 6 0	1 7 3
6	1 1 3	1 3 3	1 5 3	1 7 3	1 9 2	1 11 2
7	1 4 0	1 6 1	1 8 3	1 11 0	2 1 1	2 3 2
8	1 6 1	1 9 0	1 11 2	2 2 1	2 5 0	2 7 2
9	1 8 3	1 11 2	2 2 2	2 5 2	2 8 2	2 11 2
10	1 11 0	2 2 1	2 5 2	2 8 3	3 0 0	3 3 2
20	3 10 0	4 4 2	4 11 0	5 5 3	6 0 1	6 6 3
30	5 9 0	6 6 3	7 4 3	8 2 2	9 0 2	9 10 1
40	7 8 0	8 9 1	9 10 1	10 11 2	12 0 2	13 1 3
50	9 7 0	10 11 2	12 4 0	13 8 1	15 0 3	16 5 1
60	11 6 0	13 1 3	14 9 2	16 5 1	18 1 0	19 8 2
70	13 5 0	15 4 0	17 3 1	19 2 0	1 1 1 0	1 3 0 0
80	15 4 0	17 6 1	19 8 2	1 1 11 0	1 4 1 1	1 6 3 2
90	17 3 0	19 8 3	1 2 2 1	1 4 7 3	1 7 1 2	1 9 7 0
100	19 2 0	1 1 11 0	1 4 7 3	1 7 4 3	1 10 1 2	1 12 10 2
200	1 18 4 1	2 3 10 0	2 9 3 3	2 14 9 2	3 0 3 1	3 5 9 0
300	2 17 6 1	3 5 9 0	3 13 11 2	4 2 2 1	4 10 5 0	4 18 7 2
400	3 16 8 2	4 7 8 0	4 18 7 2	5 9 7 0	6 0 6 2	6 11 6 0
500	4 15 10 3	5 9 7 0	6 3 3 2	6 16 11 3	7 10 8 1	8 4 4 2
600	5 15 0 3	6 11 6 0	7 7 11 1	8 4 4 2	9 0 9 3	9 17 3 0
700	6 14 3 0	7 13 5 0	8 12 7 1	9 11 9 1	10 10 11 2	11 10 1 2
800	7 13 5 0	8 15 4 0	9 17 3 0	10 19 2 0	12 1 1 0	13 3 0 0
900	8 12 7 1	9 17 3 0	11 1 11 0	12 6 6 3	13 11 2 3	14 15 10 2
1000	9 11 9 1	10 19 2 2	12 6 6 3	13 13 11 2	15 1 4 1	16 8 9 0
ditto	*l.* 9.5889	*l.* 10.9587	*l.* 12.3286	*l.* 13.6984	*l.* 15.0682	*l.* 16.4379

SIMPLE INTEREST *at 5 per Cent.*

Principal. l.	130 *Days.* l. s. d. q.	140 *Days.* l. s. d. q.	150 *Days.* l. s. d. q.	160 *Days.* l. s. d. q	170 *Days.* l. s. d. q.	180 *Days.* l. s. d. q.
1	4 1	4 2	4 3	5 1	5 2	5 3
2	8 2	9 0	9 3	10 2	11 1	11 3
3	1 0 3	1 1 3	1 2 3	1 3 3	1 4 3	1 5 3
4	1 5 0	1 6 1	1 7 3	1 9 0	1 10 1	1 11 2
5	1 9 1	1 11 0	2 0 2	2 2 1	2 4 0	2 5 2
6	2 1 2	2 3 2	2 5 2	2 7 2	2 9 2	2 11 2
7	2 5 3	2 8 1	2 10 2	3 0 3	3 3 1	3 5 2
8	2 10 0	3 0 3	3 3 2	3 6 0	3 8 3	3 11 1
9	3 2 2	3 5 1	3 8 1	3 11 1	4 2 1	4 5 1
10	3 6 3	3 10 0	4 1 1	4 4 2	4 7 3	4 11 1
20	7 1 2	7 8 0	8 2 2	8 9 0	9 3 3	9 10 1
30	10 8 1	11 6 0	12 3 3	13 1 3	13 11 3	14 9 2
40	14 3 0	15 4 0	16 5 1	17 6 1	18 7 2	19 8 3
50	17 9 2	19 2 0	1 0 6 2	1 1 11 0	1 3 3 2	1 4 7 3
60	1 1 4 1	1 3 0 0	1 4 7 3	1 6 3 2	1 7 11 1	1 9 7 0
70	1 4 11 0	1 6 10 1	1 8 9 0	1 10 8 1	1 12 7 1	1 14 6 1
80	1 8 5 3	1 10 8 1	1 12 10 2	1 15 0 3	1 17 3 0	1 19 5 1
90	1 12 0 2	1 14 6 1	1 16 11 3	1 19 5 2	2 1 11 0	2 4 4 2
100	1 15 7 1	1 18 4 1	2 1 1 0	2 3 10 0	2 6 6 3	2 9 3 3
200	3 11 2 3	3 16 8 2	4 2 2 1	4 7 8 0	4 13 1 3	4 18 7 2
300	5 6 10 0	5 15 0 3	6 3 3 2	6 11 6 0	6 19 8 2	7 7 11 1
400	7 2 5 2	7 13 5 0	8 4 4 2	8 15 4 0	9 6 3 2	9 17 3 0
500	8 18 0 3	9 11 9 1	10 5 5 3	10 19 2 0	11 12 10 2	12 6 6 3
600	10 13 8 1	11 10 1 2	12 6 6 3	13 3 0 0	13 19 5 2	14 15 10 2
700	12 9 3 3	13 8 5 3	14 7 8 0	15 6 10 1	16 6 0 1	17 5 2 2
800	14 4 11 0	15 6 10 0	16 8 9 0	17 10 8 1	18 12 7 1	19 14 6 0
900	16 0 6 2	17 5 2 1	18 9 10 1	19 14 6 1	20 19 2 0	22 3 10 0
1000	17 16 1 3	19 3 6 2	20 10 11 2	21 18 4 1	23 5 9 0	24 13 1 3
ditto	*l.* 17.8078	*l.* 19.1776	*l.* 20.5479	*l.* 21.9177	*l.* 23.2875	*l.* 24.6573

SIMPLE INTEREST *at 5 per Cent.*

Principal l.	190 *Days.* l. s. d. q.	200 *Days.* l. s. d. q.	210 *Days.* l. s. d. q.	220 *Days.* l. s. d. q.	230 *Days.* l. s. d. q.	240 *Days.* l. s. d. q.
1	6 1	6 2	7 0	7 1	7 2	7 3
2	1 0 2	1 1 0	1 1 3	1 2 2	1 3 0	1 3 3
3	1 6 3	1 7 3	1 8 3	1 9 2	1 10 3	1 11 3
4	2 1 0	2 2 1	2 3 2	2 5 0	2 6 1	2 7 2
5	2 7 1	2 8 3	2 10 2	3 0 1	3 1 3	3 3 2
6	3 1 2	3 3 2	3 5 2	3 7 2	3 9 1	3 11 1
7	3 7 3	3 10 0	4 0 1	4 2 2	4 5 0	4 7 1
8	4 2 0	4 4 2	4 7 1	4 9 3	5 0 2	5 3 0
9	4 8 1	4 11 1	5 2 1	5 5 0	5 8 0	5 11 0
10	5 2 2	5 5 3	5 9 0	6 0 1	6 3 2	6 7 0
20	10 5 0	10 11 2	11 6 0	12 0 2	12 7 1	13 1 3
30	15 7 1	16 5 1	17 3 0	18 1 0	18 10 3	19 8 2
40	1 0 9 3	1 1 11 0	1 3 0 0	1 4 1 1	1 5 2 2	1 6 3 2
50	1 6 0 1	1 7 4 3	1 8 9 0	1 10 1 3	1 11 6 0	1 12 10 2
60	1 11 2 3	1 12 10 2	1 14 6 1	1 16 2 0	1 17 9 2	1 19 5 2
70	1 16 5 1	1 18 4 1	2 0 3 1	2 2 2 1	2 4 1 1	2 6 0 1
80	2 1 7 3	2 3 10 0	2 6 0 1	2 8 2 2	2 10 5 0	2 12 7 1
90	2 6 10 1	2 9 3 3	2 11 9 1	2 14 3 0	2 16 8 2	2 19 2 0
100	2 12 0 2	2 14 9 2	2 17 6 2	3 0 3 1	3 3 0 0	3 5 9 0
200	5 4 1 1	5 9 7 0	5 15 0 3	6 0 6 2	6 6 0 1	6 11 6 0
300	7 16 2 0	8 4 4 3	8 12 7 1	9 0 9 3	9 9 0 2	9 17 3 0
400	10 8 2 2	10 19 2 1	11 10 1 1	12 1 1 1	12 12 0 2	13 3 0 0
500	13 0 3 1	13 13 11 3	14 7 8 0	15 1 4 2	15 15 0 3	16 8 9 1
600	15 12 4 0	16 8 9 1	17 5 2 2	18 1 7 3	18 18 1 0	19 14 6 1
700	18 4 4 2	19 3 6 3	20 2 8 3	21 1 11 0	22 1 1 0	23 0 3 1
800	20 16 5 1	21 18 4 1	23 0 3 1	24 2 2 1	25 4 1 1	26 6 0 1
900	23 8 5 3	24 13 1 3	25 17 9 2	27 2 5 2	28 7 1 2	29 11 9 1
1000	26 0 6 2	27 7 11 1	28 15 4 0	30 2 8 3	31 10 1 2	32 17 6 1
ditto	l. 26.0271	l. 27.3969	l. 28.7671	l. 30.1368	l. 31.5067	l. 32.8765

SIMPLE INTEREST *at 5 per Cent.*

Principal.	250 *Days.*				260 *Days.*				270 *Days.*				280 *Days.*				290 *Days.*				300 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			8	1			8	2			8	3			9	1			9	2				93
2		1	4	2		1	5	0		1	5	3		1	6	2		1	7	0		1	7	3
3		2	0	3		2	1	3		2	2	2		2	3	2		2	4	2		2	5	2
4		2	8	3		2	10	1		2	11	2		3	0	3		3	2	1		3	3	2
5		3	5	1		3	6	3		3	8	1		3	10	0		3	11	3		4	1	1
6		4	1	1		4	3	1		4	5	1		4	7	1		4	9	0		4	11	1
7		4	9	2		4	11	3		5	2	1		5	4	2		5	6	3		5	9	0
8		5	5	3		5	8	2		5	11	0		6	1	2		6	4	1		6	7	0
9		6	2	0		6	5	0		6	7	3		6	11	0		7	1	3		7	4	3
10		6	10	0		7	1	2		7	4	3		7	8	0		7	11	1		8	2	2
20		13	8	2		14	3	0		14	9	2		15	4	0		15	10	3		16	5	1
30	1	0	6	2	1	1	4	2	1	2	2	1	1	3	0	0	1	3	10	0	1	4	8	0
40	1	7	4	3	1	8	5	3	1	9	7	0	1	10	8	1	1	11	9	1	1	12	10	2
50	1	14	3	0	1	15	7	1	1	16	11	3	1	18	4	1	1	19	8	3	2	1	1	0
60	2	1	1	0	2	2	8	3	2	4	4	2	2	6	0	1	2	7	8	0	2	9	3	3
70	2	7	11	1	2	9	10	1	2	11	9	1	2	13	8	2	2	15	7	1	2	17	6	2
80	2	14	9	2	2	16	11	3	2	19	2	0	3	1	4	1	3	3	6	3	3	5	9	0
90	3	1	7	3	3	4	1	1	3	6	7	0	3	9	0	2	3	11	6	0	3	13	11	3
100	3	8	5	3	3	11	2	3	3	13	11	3	3	16	8	2	3	19	5	2	4	2	2	1
200	6	16	11	3	7	2	5	2	7	7	11	1	7	13	5	0	7	18	10	3	8	4	4	2
300	10	5	5	3	10	13	8	2	11	1	11	0	11	10	1	2	11	18	4	1	12	6	6	3
400	13	13	11	2	14	4	11	1	14	15	10	2	15	6	10	1	15	17	9	2	16	8	9	0
500	17	2	5	2	17	16	2	0	18	9	10	1	19	3	6	3	16	17	3	0	20	10	11	2
600	20	10	11	2	21	7	4	3	22	3	10	0	23	0	3	1	23	16	8	2	24	13	1	3
700	23	19	5	1	24	18	7	2	25	17	9	2	26	16	11	3	27	16	2	0	28	15	4	0
800	27	7	11	1	28	9	10	1	29	11	9	1	30	13	8	1	31	15	7	1	32	17	6	1
900	30	16	5	1	32	1	1	0	33	5	9	0	34	10	5	0	35	15	0	3	36	19	8	3
1000	34	4	11	1	35	12	4	0	36	19	8	3	38	7	1	2	39	14	6	1	41	1	11	0
ditto	*l.* 34.2466				*l.* 35.6164				*l.* 36.9862				*l.* 38.3561				*l.* 39.7259				*l.* 41.0957			

SIMPLE INTEREST at 5 *per Cent.*

Principal £.	310 *Days.* l. s. d. q.	320 *Days.* l. s. d. q.	330 *Days.* l. s. d. q.	340 *Days.* l. s. d. q.	350 *Days.* l. s. d. q.	360 *Days.* l. s. d. q.	365 *Days or* 1 *Year* l. s.
1	10 0	10 2	10 3	11 1	11 2	11 3	1
2	1 8 1	1 9 0	1 9 3	1 10 1	1 11 0	1 11 3	2
3	2 6 2	2 7 2	2 8 2	2 9 2	2 10 2	2 11 2	3
4	3 4 3	3 6 0	3 7 1	3 8 3	3 10 0	3 11 1	4
5	4 3 0	4 4 2	4 6 1	4 7 3	4 9 2	4 11 1	5
6	5 1 0	5 3 0	5 5 0	5 7 0	5 9 0	5 11 0	6
7	5 11 1	6 1 2	6 4 0	6 6 1	6 8 2	6 10 3	7
8	6 9 2	7 0 0	7 2 3	7 5 2	7 8 0	7 10 3	8
9	7 7 3	7 10 3	8 1 2	8 4 2	8 7 2	8 10 2	9
10	8 6 0	8 9 0	9 0 2	9 3 3	9 7 0	9 10 1	10
20	16 11 3	17 6 1	18 1 0	18 7 2	19 2 0	19 8 3	1 0
30	1 5 5 3	1 6 3 2	1 7 1 2	1 7 11 1	1 8 9 0	1 9 7 0	1 10
40	1 13 11 3	1 15 0 3	1 16 2 0	1 17 3 0	1 18 4 1	1 19 5 2	2 0
50	2 2 5 2	2 3 10 0	2 5 2 2	2 6 6 3	2 7 11 1	2 9 3 3	2 10
60	2 10 11 2	2 12 7 1	2 14 3 0	2 15 10 2	2 17 6 1	2 19 2 1	3 0
70	2 19 5 2	3 1 4 1	3 3 3 2	3 5 2 2	3 7 1 2	3 9 0 2	3 10
80	3 7 11 1	3 10 1 2	3 12 4 0	3 14 6 1	3 16 8 2	3 18 10 3	4 0
90	3 16 5 1	3 18 10 3	4 1 4 2	4 3 10 0	4 6 3 2	4 8 9 0	4 10
100	4 4 11 1	4 7 8 0	4 10 5 0	4 13 1 3	4 15 10 2	4 18 7 2	5
200	8 9 10 1	8 15 4 0	9 0 9 3	9 6 3 2	9 11 9 1	9 17 3 0	10
300	12 14 9 2	13 3 0 0	13 11 2 3	13 19 5 1	14 7 8 0	14 15 10 3	15
400	16 19 8 3	17 10 8 1	18 1 7 3	18 12 7 0	19 3 6 3	19 14 6 1	20
500	21 4 7 3	21 18 4 1	22 12 0 2	23 5 9 0	23 19 5 1	24 13 1 3	25
600	25 9 7 0	26 6 0 1	27 2 5 2	27 18 10 3	28 15 4 0	29 11 9 1	30
700	29 14 6 1	30 13 8 1	31 12 10 2	32 12 0 2	33 11 2 3	34 10 5 0	35
800	33 19 5 1	35 1 4 1	36 3 3 2	37 5 2 2	38 7 1 2	34 9 0 2	40
900	38 4 4 2	39 9 0 1	40 13 8 1	41 18 4 1	43 3 0 0	44 7 8 0	45
000	42 9 3 3	43 16 8 2	45 4 1 1	46 11 6 0	47 18 10 3	49 6 3 2	50
tto	l. 42.4655	l. 43.8353	l. 45.2051	l. 46.5749	l. 47.9447	l. 49.3150	l. 50

A TABLE ſhewing the Number of Days between any Day of one Month, and the ſame Day of any other.

Jan. 1, &c.	Febr.	March.	April.	May	June.
Febr. 31.	*Marc.* 28.	*April* 31.	*May* 30.	*June* 31.	*July* 30.
Marc. 59.	*April* 59.	*May* 61.	*June* 61.	*July* 61.	*Aug.* 61.
April 90.	*May* 89.	*June* 92.	*July* 91.	*Aug.* 92.	*Sept.* 92.
May 120.	*June* 120.	*July* 122.	*Aug.* 122.	*Sept.* 123.	*Oct.* 122.
June 151.	*July* 150.	*Aug.* 153.	*Sept.* 153.	*Oct.* 153.	*Nov.* 153.
July 181.	*Aug.* 181.	*Sept.* 184.	*Oct.* 183.	*Nov.* 184.	*Dec.* 183.
Aug. 212.	*Sept.* 212.	*Oct.* 214.	*Nov.* 214.	*Dec.* 214.	*Jan.* 214.
Sept. 243.	*Oct.* 242.	*Nov.* 245.	*Dec.* 244.	*Jan.* 245.	*Feb.* 245.
Oct. 273.	*Nov.* 273.	*Dec.* 275.	*Jan.* 275.	*Feb.* 276.	*Mar.* 273.
Nov. 304.	*Dec.* 303.	*Jan.* 306.	*Feb.* 306.	*Mar.* 304.	*Apr.* 304.
Dec. 334.	*Jan.* 334.	*Feb.* 337.	*Mar.* 334.	*Apr.* 335.	*May* 334.
Jan. 365.	*Feb.* 365.	*Mar.* 365.	*Apr.* 365.	*May* 365.	*June* 365.

July.	Auguſt.	Septemb.	October.	Novemb.	Decemb.
Aug. 31.	*Sept.* 31.	*Octob.* 30.	*Nov.* 31.	*Dec.* 30.	*Jan.* 31.
Sept. 62.	*Octob.* 61.	*Nov.* 61.	*Dec.* 61.	*Jan.* 61.	*Febr.* 62.
Oct. 92.	*Nov.* 92.	*Dec.* 91.	*Jan.* 92.	*Febr.* 92.	*Mar.* 90.
Nov. 123.	*Dec.* 122.	*Jan.* 122.	*Feb.* 123.	*Mar.* 120.	*Apr.* 121.
Dec. 153.	*Jan.* 153.	*Feb.* 153.	*Mar.* 151.	*Apr.* 151.	*May* 151.
Jan. 184.	*Feb.* 184.	*Mar.* 181.	*Apr.* 182.	*May* 181.	*June* 182.
Feb. 215.	*Mar.* 212.	*Apr.* 212.	*May* 212.	*June* 212.	*July* 212.
Mar. 243.	*Apr.* 243.	*May* 242.	*June* 243.	*July* 242.	*Aug.* 243.
Apr. 274.	*May* 273.	*June* 273.	*July* 273.	*Aug.* 273.	*Sept.* 274.
May 304.	*June* 304.	*July* 303.	*Aug.* 304.	*Sept.* 304.	*Oct.* 304.
June 335.	*July* 334.	*Aug.* 334.	*Sept.* 335.	*Oct.* 334.	*Nov.* 335.
July 365.	*Aug.* 365.	*Sept.* 365.	*Oct.* 365.	*Nov.* 365.	*Dec.* 365.

The Use of the foregoing Tables.

1. This Table last above I shall first shew the Use of, because it is naturally in Use before that of Simple Interest.

Example.] How many Days is contained between the 19th of *November* and the 28th of *March* following?

Rule.] This Table shews, that from *November* (19, *&c.*) to the same Day of *March*, it is 120 Days. To which adding the Days that 28 exceeds nineteen, *viz.* 9, gives 129 Days for Answer. But in case the Days you reckon to, are not so many as those you reckon from; then substract the difference. As, to find the Days between the 28th of *November* and the 19th of *March*; *November* 28, *&c.* to the same Day of *March* is 120 Days (as before) from which deducting what 28 exceeds the 19th of *November*, and the Remainer is 111 Days the Answer.

The Use of the Table of Simple Interest, at 5 per Cent.

Example 1.] What is the Interest of *l.* 700 from the 5th of *July* to the 13th of *April* following, at 5 *per Cent?*

The time is 282 Days, and against *l.* 700 under 280 Days, is —— } *l.* 26 : 16 : 11 $\frac{3}{4}$

And under 2 Days is —— : 3 : 10

Answ. l. 27 : —— : 9 $\frac{3}{4}$

Example 2.] To find the Interest of *l.* 470 from the 18th of *December* to the 5th of *April*, at 5 *per Cent.* The Time is 108 Days; and

	Days.	
l. 400, under	100	= *l.* 5 : 9 : 7
l. 70, under	100	= —— : 19 : 2
l. 400, under	8	= —— : 8 : 9 $\frac{3}{4}$
l. 70, under	8	= —— : 1 : 6

Sum or Answer = *l.* 6 : 19 : —— $\frac{1}{4}$

3. Or any more odd or larger Sums in Questions of this kind may be multiplied one in another, and the Product of the Days and Pounds by the .00013699 at the beginning of the Table of 5 *per Cent.* for Answer.

4. If you would find the Interest of *l.* 4700 (or other Sum above 1000) for 108, *&c.* Days; under 100 Days and 8 Days against ditto you find the marginal Numbers, whose Sum being multiplied by 4.7 (= 4700) gives the Answer *l.* 69 : 10 : 7 $\frac{1}{2}$.

Against ditto under 100 is 13.6984
under 8 is 1.0956

Sum *l.* 14.7940
Multiply by 4.7

Product Answ. = 69.5318

Such Perſons as are minded to have an Inſtrument whereby to find the Number of Days between any two in the Year, may ſee the Form of one, *Plate* A. *Fig.* 25, and 26. which being done in Braſs, and of a ſix-inch Radius, will moſt eaſily and accurately anſwer their End.

The Deſcription and Uſe of the Circles of Days and Months, (Fig. 25, 26. Plate A.)

This conſiſts of a Circle (as *Fig.* 26.) divided into 365 Days, which is to turn round concentrically in a Circle, (*Fig.* 25.) divided into the Months in the Year, and each Month into its reſpective Days: ſo that the inner Circle naturally meaſures the Days between any two in any of the Months, in order to *find the Intereſt or Diſcount* for thoſe *Days*.

Example.] How many Days are contained between the 15th of *November* and the 2d of *May* following?

For Anſwer, turn the Hand in the inner Circle to the 15th of *November* in the outer Circle, and againſt the 2d of *May* in that outer, you will find in the inner Circle 168 Days, including the Day you reckon from, and excluding that which you reckon to.

Rules how by the two Tables of 4 *and* 5 per Cent. *above, to find the Intereſt at any Rate from* 1 *to* 10 per Cent. *incluſive, very eaſily and briefly.*

For inſtance, *l.* 500 for 170 Days.

Rules.	*Examples.*
For 1 *per Cent.* take a fourth of the Int. at 4 *per Cent.*	*l.* 9 : 6 : 3 : 3 of which $\frac{1}{4}$ is *l.* 2 : 6 : 6 $\frac{3}{4}$ Anſwer.
2 *per Cent.* take half the Intereſt at 4 *per Cent.*	*l.* 9 : 6 : 3 : 3; $\frac{1}{2}$ is 4 : 13 : 1 $\frac{3}{4}$ Anſwer.
3 *per Cent.* is the Intereſt at 4 *per Cent.* leſs a 4th thereof ——	*l.* 2 : 6 : 6 : 3 = 6 : 19 : 9 Anſwer.
6 *per Cent.* is the Intereſt at 4 *per Cent.* more half thereof ——	9 : 6 : 3 : 3 more 4 : 13 : 1 : 3 or 13 : 19 : 5 $\frac{1}{2}$ Anſw.
7 *per C.* take the Int. of 1 *p. C.* from the Int. of 8 *p. C.* found thus	as 8 *p. C.* is = 18 : 12 : 7 : 2 / 1 *p. C.* leſs = 2 : 6 : 6 : 3 gives 16 : 6 : — $\frac{3}{4}$ Anſ.

Rules.

Rules.	*Examples.*
For 8 *per Cent.* add the Int. at 4 *per Cent.* to itself	18 : 12 : 7 : 2 = 18 : 12 : 7 $\frac{2}{2}$ Answ.
4 *per Cent.* is	9 : 6 : 3 : 3
9 *per Cent.* add the Int. at 4 and 5 *per* C. together	Sum 20 : 19 : 2 $\frac{1}{4}$ Answ.
5 *per Cent.* is	11 : 12 : 10 : 2
10 *per Cent.* add the Int. at 5 *per Cent.* to itself——	11 : 12 : 10 : 2
more	11 : 12 : 10 : 2
	Sum 23 : 5 : 9 Answ.

II. *The Use of Decimals in calculating Discount.*

This matter wants very much to be set in a clear Light, for I have not yet seen it done; tho I have not perhaps seen all that has been wrote upon it: But I know that a learned Author in Folio has intirely mistaken it.

1. The *Discount* of Money is the Allowance made by the Creditor out of a Sum of Money due to him at the end of some number of Days, in consideration of the prompt Payment of the Remainer by the Debtor.

2. That Sum paid down instead of the Principal due hereafter, may properly be called *the present Worth*; in regard that if it were put out to Interest for the Days that the Discount is computed, it would amount to the Principal due at the end of those Days.

3. The Interest for any time is more than the Discount for that time; because (suppose of *l.*1 for 1 Day at *6 per Cent.*) the Quotient must be more when .016438 (= the Interest of *l.* 100 for one Day) is divided only by 100, than when it is divided by *l.* 100.016438.

4. To find *the present Worth* of *l.*1. due 1 Day hence at *6 per Cent.*

	Days.	*l. Int.*		*Day.*	*l. Int.*	
1*st*, As	365.	6	: :	1.	.016438	
	l.	*l.*		*l.*	*l.*	Answer.
2*dly*, As	100.016438.	100	: :	1	.99983565	

5. For the Discount of *l.* 1 for 1 Day.

1*st*, As	365.	6	: :	1.	.016438	
2*dly*, As	100.016438.	.016438	: :	1	to	.00016435

Here the Sum of the present Worth and Discount makes up the Principal payable at time, as a Proof of the Truth of both. Sum Proof, *l.*1.00000000

6. Ano-

6. Another way to prove this, is to try whether the Amount of the present Worth for the time, will make up the Principal due at that time thus:

l. *l.* *l.*
100. 100.016438 :: 99983565. to *l.* 1

Whence I find, that if *l.* 100 in 1 Day amount to 100.016438; then the said present Worth of 1 *l.* due at the end of 1 Day, will amount to *l.* 1: which is a second Proof of the true Computation of the present Worth and Discount above.

7. To illustrate this matter farther, I shall give another Example at large; which shall be to find the Discount of *l.* 1000 payable at the end of 90 Days at 6 *per Cent.*

See the Operation.

Days. *l.* *Days.*
1*st*, 365. 6 :: 90

6

2*dly*, As 101.47945. 1.47945 :: 1000. 14.57882 | ———

1000 365) 540.(1.47945

l. 175.0 (=100,

101.47945) 1479.45000 (14.57882 Answ. | 290.0 for 90 days

4646555o 345.0

58 73770.0 165.0

7 99777 5.0 19 0.0

89421 3 5.0

8237 7 9 0.0

219 4 3 4 0

And for Proof 101.47945. 100 :: 1000. 985.42118 = pref. Worth.
Which added to the Discount = ... 14.57882 = 1000
Or for Proof say, 100. 101.47945 :: 985.42118. 1000

8. *A New Way of Calculating Discount and Present Worth.*

But because there are two Divisions, and one of them very operose, I have Algebraically (as you may see in the Use of Algebra) contrived this Rule or Canon, which has but one, and that a shorter Division.

1. *For the present Worth*; Multiply the Days in a Year, the Principal given, and 100, in each other, for the Dividend. And add the Product of 365 by 100 to that of the Days multiplied in the Rate given, and the Sum is the Divisor: so the Quote arising is the Answer.

In

In the last Example, 365 in 100 is 36500, that in 1000 makes 36500000, without farther trouble; then 365 by 100 = 36500; more 90 Days in 6 (the Rate) is 540; and that Sum is = 37040, the Divisor. See the Work.

3704.0) 3650000.0 (985.42117 = the Answer, or present Worth.
31640
2008.0
1560.0
784.0
432.0
616.0
2456.0

2. For *Discount*; Multiply the Rate in the Principal given, and that in the Days given is your Dividend. And the Product of 365 Days by 100 added to that of the Days, in the Rate given, is the Divisor. Thus the Principal in the Rate is ——— = 6000
By the Days = 90

And 365 in 100 = 36500
More 90 in 6 = 540

Divisor = 37040 Sum.

3704.0) 54000.0 = *Div^d.* (14.57883 = *Discount, as before.*
16960
2144.0
2920.0
3272.0
3088.0
1248.0

Note, By this last Method you use fewer Figures by above 40, and have not a third of the trouble.

9. In Dr. *Harris's Lexicon* the Discount for one Day is asserted to be the 365th part of that for a Year: However this Mistake came, I know not; but his two Folio Pages of Table of Discount being made upon the same Principle, are likewise erroneous. And to prove this, it is sufficient from the foregoing due Calculation, That the Discount of *l.*1 for 1 Day, at *6 per Cent.* is .00016435, and not .0001550788, as the *Lexicon* makes it. And to pretend that multiplying the Discount of *l.*1 for 1 Day, gives the Discount of one Pound for other Days by which you multiply, is a wrong Notion; because every Day's Discount of *l.*1 differs, being less according as that Day is distant from 1, as appears plain from what follows.

This is a full Indication that one Day's Discount at the beginning of the Year is much more than at the middle or end: and therefore were the last Example above of the Discount of *l.* 1000 for 90 Days to be done by the Tables in the *Lexicon*, it would be *l.* 13 : 19 : 1¾ but ——— 13 : 19 : 1¾
Whereas 'tis in truth by the Calculation above ——— 14 : 11 : 6¾
So that the said *Lexicon*-Tables err in this Instance 12 *s.* 5 *d.* And were the Days fewer, for which the Discount is required, the Error would be proportionably greater.

Days.	*Discount of* l. 1 *for those Days at* 6 per Cent.	*Differences, or each Day's Discount.*
1	.00016435	
2	.00032865	.00016430
3	.0004929	.00016425
4	.0006571	.0001642
180	.02873 86	
181	.0288937	.0001551
182	.0290487	.0001550
183	.0292036	.0001549
362	.05616456	
363	.05631106	.00014642
364	.05645744	.00014638
365	.05660377	.00014633

Hence it may be inferred, That no Tables of Discount can be used with accuracy, but such as have the Discount for every Day in the Year, because every Day's Discount differeth. And had I time, and room in this Book, I would oblige the Publick with a Table of Discount for every Day, because I know not of any true Table of Discount extant. But in the mean time, the following will be better than any yet published, and will be found accurate enough in Practice.

A TABLE *of* DISCOUNT *at 4 per Cent. per Ann. more Accurate than any extant.*

Prin-cipal.	1 Day.			2 Days.			3 Days.			4 Days.			5 Days.			6 Days.			7 Days.			8 Days.		
l.	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*
1																				1			1	
2									1			1			1			1		1			1	
3						1			1			1			1			2		2			2	
4						1			1			2			2			2		3			3	
5						1			1			2			2			3	1	0		1	0	
6			1			1			1			2			3	1	0		1	0		1	1	
7			1			1			2			3	1	0		1	0		1	1		1	2	
8			1			2			2			3	1	0		1	1		1	2		1	3	
9			1			2			3		1	0	1	1		1	2		1	3		1	3	
10			1			2			3		1	0	1	1		1	2		1	3		2	0	
20			2		1	0		1	2		2	0		2	2		3	1		3	3		4	1
30			3		1	2		2	1		3	1		4	0		4	3		5	2		6	1
40		1	0		2	0		3	1		4	1		5	1		6	1		7	1		8	2
50		1	1		2	2		4	0		5	1		6	2		7	3		9	1		10	2
60		1	2		3	1		4	3		6	1		7	3		9	2		11	0		1	0 2
70		1	3		3	3		5	2		7	1		9	1		11	0	1	0	3		1	2 3
80		2	0		4	1		6	1		8	2		10	2	1	0	2	1	2	3		1	5 0
90		2	1		4	3		7	0		9	2	1	0	0	1	2	1	1	4	2		1	7 0
100		2	2		5	1		7	3		10	2	1	1	0	1	3	3	1	6	2		1	9 0
200		5	1		10	2	1	3	3	1	9	0	2	2	1	2	7	2	3	0	3		3	6 0
300		7	3	1	3	3	1	11	3	2	7	2	3	3	2	3	11	2	4	7	1		5	3 0
400		10	2	1	9	0	2	7	2	3	6	0	4	4	3	5	3	0	6	1	2		7	0 0
500	1	1	1	2	2	1	3	3	2	4	4	3	5	5	3	6	6	3	7	8	0		8	9 0
600	1	3	3	2	7	2	3	11	2	5	3	0	6	6	3	7	10	3	9	2	1		10	6 0
700	1	6	1	3	0	3	4	7	1	6	1	2	7	8	0	9	2	1	10	8	3		12	3 1
800	1	9	0	3	6	0	5	3	0	7	0	0	8	9	1	10	6	0	12	3	1		14	0 1
900	1	11	3	3	11	2	5	11	0	7	10	3	9	10	1	11	10	0	13	9	2		15	9 1
1000	2	2	1	4	4	3	6	6	3	8	9	1	10	11	2	13	1	3	15	4	0		17	6 1
ditto	*l.* .10957			*l.* .21913			*l.* .32865			*l.* .43816			*l.* .54764			*l.* .6571			*l.* .76653			*l.* .87594		

A TABLE *of* DISCOUNT *at* 4 *per Cent.*

Principal. l.	9 *Days.* s. d. q.	10 *Days.* l. s. d. q.	20 *Days.* l. s. d. q.	30 *Days.* l. s. d. q.	40 *Days.* l. s. d. q.	50 *Days.* l. s. d. q.	60 *Days.* l. s. d. q.
1	1	1	0 2	3	1 0	1 1	1 2
2	2	2	1 0	1 2	2 0	2 2	3 1
3	3	3	1 2	2 1	3 1	4 0	4 3
4	1 0	1 0	2 1	3 1	4 1	5 1	6 1
5	1 1	1 1	2 3	4 0	5 1	6 2	7 3
6	1 2	1 2	3 1	4 3	6 1	7 3	9 2
7	1 3	1 3	3 3	5 2	7 1	9 1	11 0
8	2 0	2 1	4 1	6 1	8 1	10 2	1 0 2
9	2 1	2 2	4 3	7 0	9 2	11 3	1 2 0
10	2 2	2 3	5 1	7 3	10 2	1 1 0	1 3 3
20	4 3	5 1	10 2	1 3 3	1 9 0	2 2 1	2 7 1
30	7 0	7 3	1 3 3	1 11 3	2 7 2	3 3 1	3 11 0
40	9 2	10 2	1 9 0	2 7 2	3 6 0	4 4 1	5 2 3
50	1 0 0	1 1 0	2 2 1	3 3 1	4 4 2	5 5 1	6 6 2
60	1 2 1	1 3 3	2 7 2	3 11 1	5 2 3	6 6 2	7 10 0
70	1 4 2	1 6 1	3 0 3	4 7 0	6 1 1	7 7 2	9 1 3
80	1 7 0	1 9 0	3 6 0	5 3 0	7 0 0	8 8 2	10 5 2
90	1 9 1	1 11 3	3 11 1	5 10 3	7 10 1	9 9 3	11 9 0
100	1 11 3	2 2 1	4 4 2	6 6 2	8 8 3	10 10 3	13 0 3
200	3 11 2	4 4 2	8 9 0	13 1 1	17 5 2	1 1 9 2	1 6 1 2
300	5 11 0	6 6 3	13 1 2	19 8 0	1 6 2 1	1 12 8 2	1 19 2 1
400	7 10 3	8 9 0	17 6 0	1 6 2 2	1 14 11 0	2 3 7 1	2 12 3 0
500	9 10 1	10 11 2	1 1 10 2	1 12 9 1	2 3 7 3	2 14 6 0	3 5 4 0
600	11 10 0	13 1 2	1 6 3 0	1 19 4 0	2 12 4 2	3 5 4 3	3 18 4 3
700	13 9 2	15 4 0	1 10 7 1	2 5 10 2	3 1 1 1	3 16 3 2	4 11 5 2
800	15 9 1	17 6 0	1 15 0 0	2 12 5 0	3 9 10 0	4 7 2 1	5 4 6 1
900	17 8 3	19 8 2	1 19 4 2	2 18 11 3	3 18 6 3	4 18 1 0	5 17 7 0
1000	19 8 2	1 1 10 3	2 3 8 3	3 5 6 2	4 7 3 2	5 9 0 0	6 10 7 3
ditto	*l.* .98532	*l.* 1.09469	*l.* 2.18699	*l.* 3.27689	*l.* 4.36443	*l.* 5.44959	*l.* 6.53239

A TABLE *of* DISCOUNT *at 4 per Cent. per Ann.*

Principal.	70 *Days.*				80 *Days.*				90 *Days.*				100 *Days.*				110 *Days.*				120 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			1	3			2	0			2	1			2	3			3	0			3	1
2			3	3			4	1			4	3			5	1			5	3			6	1
3			4	2			6	1			7	0			7	3			8	2			9	1
4			7	1			8	1			9	2			10	2			11	2		1	0	2
5			9	1			10	2			11	3		1	1	0		1	2	1		1	3	2
6			11	0		1	0	2		1	2	0		1	3	3		1	5	1		1	6	3
7		1	0	3		1	2	2		1	4	2		1	6	1		1	8	0		1	9	3
8		1	2	2		1	4	3		1	6	3		1	8	3		1	11	0		2	1	0
9		1	4	2		1	6	3		1	9	0		1	11	2		2	1	3		2	4	0
10		1	6	1		1	8	3		1	11	2		2	2	0		2	4	3		2	7	1
20		3	0	2		3	5	3		3	11	0		4	4	1		4	9	1		5	2	1
30		4	6	3		5	2	2		5	10	1		6	6	0		7	1	3		7	9	2
40		6	1	0		6	11	2		7	9	3		8	8	0		9	6	1		10	4	3
50		7	7	1		8	9	1		9	9	1		10	10	0		11	11	0		12	11	3
60		9	1	2		10	5	1		11	8	3		13	0	0		14	3	2		15	7	0
70		10	7	3		12	2	0		13	8	0		15	0	2		16	8	0		18	2	0
80		12	2	1		13	11	0		15	7	2		17	4	1		19	0	2	1	0	9	1
90		13	8	2		15	7	3		17	7	0		19	6	1	1	1	5	2	1	3	4	2
100		15	2	3		17	4	3		19	6	2	1	1	8	1	1	3	10	0	1	5	11	2
200	1	10	5	2	1	14	9	1	1	19	0	3	2	3	4	2	2	7	7	3	2	11	11	1
300	2	5	8	0	2	12	1	3	2	18	7	1	3	5	0	2	3	11	5	3	3	17	10	3
400	3	0	11	0	3	9	6	1	3	18	1	2	4	6	8	3	4	15	3	2	5	3	10	1
500	3	16	1	2	4	6	11	0	4	17	8	1	5	8	5	0	5	19	1	1	6	9	9	3
600	4	11	4	1	5	4	3	2	5	17	2	2	6	10	1	0	7	2	11	1	7	15	9	1
700	5	6	7	0	6	1	8	0	6	1	8	3	7	11	9	1	8	6	9	0	9	1	8	3
800	6	1	9	3	6	19	0	3	7	16	3	1	8	13	5	2	9	10	7	0	10	7	8	1
900	6	17	0	1	7	16	5	1	8	15	9	2	9	15	1	2	10	14	5	0	11	13	7	3
1000	7	12	3	0	8	13	9	3	9	15	4	0	10	16	9	3	11	18	2	3	12	19	7	1
ditto	*l.* 7.61283				*l.* 8.69092				*l.* 9.76668				*l.* 10.84011				*l.* 11.9112				*l.* 12.98			

A TABLE *of* DISCOUNT *at* 4 *per Cent. per Ann.*

Principal. l.	130 *Days.* l. s. d. q.	140 *Days.* l. s. d. q.	150 *Days.* l. s. d. q.	160 *Days.* l. s. d. q.	170 *Days.* l. s. d. q.	180 *Days.* l. s. d. q.
1	3 2	3 3	4 0	4 1	4 2	4 3
2	6 3	7 1	7 3	8 1	8 3	9 1
3	10 1	11 0	11 3	1 0 1	1 1 1	1 2 0
4	1 1 2	1 2 2	1 2 2	1 4 2	1 5 2	1 6 2
5	1 5 0	1 6 0	1 7 2	1 8 3	1 10 0	1 11 1
6	1 8 1	1 9 3	1 11 1	2 0 3	2 2 2	2 4 0
7	1 11 3	2 1 2	2 3 1	2 5 0	2 6 3	2 8 2
8	2 3 0	2 5 0	2 7 0	2 9 0	2 11 1	3 1 0
9	2 6 1	2 8 3	2 11 0	3 1 1	3 3 2	3 5 3
10	2 9 3	3 0 1	3 2 3	3 5 2	3 7 3	3 10 2
20	5 7 2	6 0 2	6 5 2	6 10 3	7 3 3	7 8 3
30	8 5 1	9 0 3	9 8 2	10 4 1	10 11 3	11 7 1
40	11 2 3	12 1 0	12 11 1	13 9 2	14 7 2	15 5 3
50	14 0 2	15 1 1	16 2 0	17 2 3	18 3 2	19 4 1
60	16 10 1	18 1 2	19 5 0	1 0 8 0	1 1 11 2	1 3 2 2
70	19 8 0	1 1 2 0	1 2 7 3	1 4 1 2	1 5 7 1	1 7 1 0
80	1 2 5 3	1 4 2 1	1 5 10 2	1 7 6 3	1 9 3 1	1 10 11 2
90	1 5 3 2	1 7 2 2	1 9 1 1	1 11 0 1	1 12 11 1	1 14 9 3
100	1 8 1 0	1 10 2 3	1 12 4 1	1 14 5 3	1 16 7 0	1 18 8 1
200	2 16 2 1	3 0 5 2	3 4 8 1	3 8 11 1	3 13 1 3	3 17 4 2
300	4 4 3 1	4 10 8 1	4 17 0 2	5 3 4 3	5 9 8 3	5 16 0 3
400	5 12 4 2	6 0 11 0	6 9 4 3	6 17 10 1	7 6 3 3	7 14 9 0
500	7 0 5 2	7 11 1 2	8 1 8 3	8 12 4 0	9 2 10 3	9 13 5 2
600	8 8 6 3	9 1 4 1	9 14 0 3	10 6 9 2	10 19 5 3	11 12 1 2
700	9 16 7 3	10 11 7 0	11 6 5 0	12 1 3 0	12 16 0 2	13 10 10 0
800	11 4 9 0	12 1 9 3	12 8 9 1	13 15 8 2	14 12 7 2	15 9 6 0
900	12 12 10 0	13 12 0 2	14 11 1 1	15 10 2 0	16 9 2 2	17 8 2 2
1000	14 0 11 1	15 2 3 1	16 3 5 2	17 4 7 3	18 5 9 2	19 6 10 3
ditto	*l.* 14.04646	*l.* 15.11333	*l.* 16.17251	*l.* 17.23209	*l.* 18.2894	*l.* 19.34444

A TABLE *of* DISCOUNT *at 4 per Cent. per Ann.*

Principal.	190 *Days.*				200 *Days.*				210 *Days.*				220 *Days.*				230 *Days.*				240 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			5	0			5	1			5	2			5	3			6	0			6	1
2			9	3			10	1			10	3			11	2		1	0	0		1	0	1
3		1	2	3		1	3	2		1	4	1		1	5	0		1	5	3		1	6	2
4		1	7	2		1	8	2		1	9	2		1	10	3		1	11	3		2	0	2
5		2	0	2		2	1	3		2	3	0		2	4	1		2	5	2		2	6	3
6		2	5	2		2	6	3		2	8	1		2	10	0		2	11	2		3	1	0
7		2	10	1		3	0	0		3	1	3		3	3	2		3	5	2		3	7	0
8		3	3	1		3	5	1		3	7	1		3	9	1		3	11	1		4	1	1
9		3	8	0		3	10	2		4	0	2		4	2	3		4	5	1		4	7	1
10		4	1	0		4	3	2		4	6	0		4	8	2		4	11	0		5	1	2
20		8	2	0		8	7	0		9	0	0		9	5	0		9	10	0		10	3	0
30		12	2	3		12	10	2		13	6	0		14	1	2		14	9	0		15	4	2
40		16	3	3		17	2	0		18	9	0		18	10	0		19	8	0	1	0	6	0
50	1	0	4	3	1	1	5	1	1	2	6	0	1	3	6	2	1	4	7	0	1	5	7	2
60	1	4	5	3	1	5	8	3	1	7	0	0	1	8	3	0	1	9	6	0	1	10	9	0
70	1	8	6	3	1	10	0	1	1	11	6	0	1	12	11	2	1	14	5	0	1	15	10	2
80	1	12	7	2	1	14	3	3	1	16	0	0	1	17	8	0	1	19	4	0	2	1	0	0
90	1	16	8	2	1	18	7	1	2	0	6	0	2	2	4	2	2	4	3	0	2	6	1	2
100	2	0	9	2	2	2	10	3	2	5	0	0	2	7	1	0	2	9	2	0	2	11	3	0
200	4	1	7	0	4	5	9	2	4	9	11	3	4	14	2	0	4	18	4	1	5	2	6	0
300	6	2	4	3	6	8	8	1	6	14	11	3	7	1	3	0	7	7	6	1	7	13	9	1
400	8	3	2	0	8	11	7	0	8	19	11	3	9	8	4	0	9	16	8	2	10	5	0	0
500	10	3	11	3	10	14	5	3	11	4	11	2	11	15	5	0	12	5	10	1	12	16	3	1
600	12	4	9	1	12	17	4	2	13	9	11	2	14	2	6	0	14	15	0	1	15	7	6	1
700	14	5	6	3	15	0	3	1	15	14	11	2	16	9	7	0	17	4	2	2	17	18	9	2
800	16	6	4	1	17	3	2	0	17	19	11	1	18	16	8	0	19	13	4	2	20	10	0	2
900	18	7	1	3	19	6	0	3	20	4	11	1	21	3	9	0	22	2	6	2	23	1	3	2
1000	20	7	11	2	21	8	11	2	22	9	11	0	23	10	10	0	24	11	8	2	25	12	6	2
ditto	*l.* 20.3972				*l.* 21.44772				*l.* 22.49598				*l.* 23.542				*l.* 24.58578				*l.* 25.62733.			

A TABLE *of* DISCOUNT *at* 4 *per Cent. per Ann.*

Principal.	250 *Days.*	260 *Day.*	270 *Days.*	280 *Days.*	290 *Days.*	300 *Days.*
l.	*l. s. d. q.*	*s. l. d. q.*	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*	*l. s. d. q.*
1	6 2	6 3	7 0	7 0	7 1	7 2
2	1 0 3	1 1 1	1 1 3	1 2 1	1 2 3	1 3 1
3	1 7 1	1 8 0	1 8 3	1 9 2	1 10 1	1 11 0
4	2 1 2	2 2 2	2 3 2	2 4 3	2 5 2	2 6 2
5	2 8 0	2 9 1	2 10 2	2 11 3	3 1 0	3 2 1
6	3 2 2	3 4 0	3 5 2	3 7 0	3 8 1	3 9 3
7	3 8 3	3 10 2	4 0 1	4 2 0	4 3 3	4 5 2
8	4 3 1	4 5 1	4 7 1	4 9 1	4 11 1	5 1 0
9	4 9 2	5 0 0	5 2 0	5 4 1	5 6 2	5 8 3
10	5 4 0	5 6 2	5 9 0	5 11 2	6 2 0	6 4 2
20	10 8 0	11 1 0	11 6 0	11 11 0	12 4 0	12 8 3
30	16 0 0	16 7 2	17 3 0	17 10 2	18 5 3	19 1 1
40	1 1 4 0	1 2 2 0	1 3 0 0	1 3 9 3	1 4 7 3	1 5 5 2
50	1 6 8 0	1 7 8 2	1 8 8 3	1 9 9 1	1 10 9 2	1 11 10 0
60	1 12 0 0	1 13 3 0	1 14 5 3	1 15 8 3	1 16 11 3	1 18 2 1
70	1 17 4 0	1 18 9 2	2 0 2 3	2 1 8 1	2 3 1 2	2 4 6 3
80	2 2 8 0	2 4 4 0	2 5 11 3	2 7 7 2	2 9 3 2	2 10 11 1
90	2 8 0 0	2 9 10 2	2 11 8 3	2 13 7 0	2 15 5 1	2 17 3 2
100	2 13 4 0	2 15 5 0	2 17 5 3	2 19 6 2	3 1 7 1	3 3 8 0
200	5 6 8 0	5 10 9 3	5 14 11 2	5 19 1 0	6 3 2 2	6 7 4 0
300	8 0 0 0	8 6 2 3	8 12 5 1	8 18 7 2	9 4 9 3	9 10 11 3
400	10 13 4 0	11 1 7 2	11 9 11 0	11 18 2 0	12 6 5 0	12 14 7 3
500	13 6 8 0	13 17 0 2	14 7 4 3	14 17 8 2	15 8 0 1	15 18 3 3
600	16 0 0 0	16 12 5 2	17 4 10 2	17 17 3 0	18 9 7 2	19 1 11 3
700	18 13 4 0	19 7 10 1	20 2 4 1	20 16 9 2	21 11 2 3	22 5 7 2
800	21 6 8 0	22 3 3 1	22 19 9 3	23 16 4 1	24 12 10 0	25 9 3 2
900	24 0 0 0	24 18 8 0	25 17 3 2	26 15 10 3	27 14 5 1	28 12 11 2
1000	26 13 4 0	27 14 1 0	28 14 9 1	29 15 5 1	30 16 0 2	31 16 7 1
ditto	*l.* 26.6 *r*	*l.* 27.70378	*l.* 28.73853	*l.* 29.77139	*l.* 30.8019	*l.* 31.83024

A TABLE *of* DISCOUNT *at 4 per Cent. per Ann.*

Principal.	310 *Days.*				320 *Day.*				330 *Days.*				340 *Days.*				350 *Days.*				360 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			7	3			8	0			8	2			8	3			9	0			9	1
2		1	3	3		1	4	2		1	4	3		1	5	1		1	5	3		1	6	1
3		1	11	3		2	0	1		2	1	1		2	1	3		2	2	2		2	3	1
4		2	7	2		2	8	2		2	9	2		2	10	2		2	11	2		3	0	2
5		3	3	2		3	4	3		3	6	0		3	7	0		3	8	1		3	9	2
6		3	11	2		4	0	3		4	2	1		4	3	3		4	5	1		4	6	3
7		4	7	1		4	9	0		4	10	3		5	0	1		5	2	0		5	3	3
8		5	3	1		5	5	1		5	7	0		5	9	0		5	11	0		6	0	3
9		5	11	0		6	1	1		6	3	2		6	5	2		6	7	3		6	10	0
10		6	6	3		6	9	1		6	11	3		7	2	1		7	4	3		7	7	0
20		13	1	3		13	6	3		13	11	2		14	4	2		14	9	1		15	2	1
30		19	8	2	1	0	4	0	1	0	11	1	1	1	6	3	1	2	2	0	1	2	9	1
40	1	6	3	2	1	7	1	1	1	7	11	1	1	8	8	3	1	9	6	2	1	10	4	2
50	1	12	10	2	1	13	10	3	1	14	11	0	1	15	11	0	1	16	11	1	1	17	11	2
60	1	19	5	1	2	0	7	3	2	1	10	3	2	3	1	1	2	4	4	0	2	5	6	2
70	2	6	0	0	2	7	5	1	2	8	10	2	2	10	3	2	2	11	8	2	2	13	1	3
80	2	12	7	0	2	14	2	2	2	15	10	1	2	17	5	3	2	19	1	1	3	0	8	3
90	2	19	1	3	3	0	11	3	3	2	10	0	3	4	8	0	3	6	6	0	3	8	4	0
100	3	5	8	3	3	7	9	1	3	9	9	3	3	11	10	1	3	13	10	2	3	15	11	0
200	6	11	5	2	6	15	6	1	6	19	7	1	7	3	8	1	7	7	9	0	7	11	9	3
300	9	17	2	0	10	3	3	2	10	9	5	0	10	15	6	1	11	1	7	2	11	7	8	3
400	13	2	11	0	13	11	0	2	13	19	2	2	14	7	4	2	14	15	6	1	15	3	7	2
500	16	8	7	2	16	18	9	3	17	9	0	1	17	19	2	2	18	9	4	3	18	19	6	2
600	19	14	4	1	20	6	6	3	20	18	10	0	21	11	0	3	22	3	3	1	22	15	5	2
700	23	0	1	0	23	14	4	0	24	8	7	2	25	2	11	0	25	17	1	3	26	11	4	2
800	26	5	9	3	27	2	1	0	27	18	5	1	28	14	9	0	29	11	0	1	30	7	3	1
900	29	11	6	1	30	9	10	1	31	8	2	3	32	6	7	0	33	4	11	0	34	3	2	1
1000	32	17	3	1	33	17	7	1	34	18	0	2	35	18	5	1	36	18	9	2	37	19	1	0
ditto	*l.* 32.86275				*l.* 33.88038				*l.* 34.90216				*l.* 35.92181				*l.* 36.93931				*l.* 37.95466			

Discount at 4 per Cent.

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal.	365 *Days, or* 1 *Year.*				1 *Day.*			2 *Days.*			3 *Days.*			4 *Days.*		
l.	*l.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*
1			9	1												
2		1	6	2								1				1
3		2	3	3						1		1				1
4		3	1	0						1		1				1
5		3	10	1						1		1				2
6		4	7	1			1			1		2				2
7		5	4	3			1			1		2				3
8		6	1	3			1			2		2				3
9		6	11	1			1			2		3			1	0
10		7	8	1			1			2		3			1	0
20		15	4	3			2		1	0		1	2		2	0
30	1	3	1	0			3		1	2		2	1		3	0
40	1	10	9	1		1	0		2	0		3	0		4	0
50	1	18	5	2		1	1		2	2		3	3		5	0
60	2	6	1	3		1	2		3	0		4	2		6	0
70	2	13	10	1		1	3		3	2		5	1		7	0
80	3	1	6	2		2	0		4	0		6	0		8	0
90	3	9	2	3		2	1		4	2		6	3		9	0
100	3	16	11	1		2	2		5	0		7	2		10	0
200	7	13	10	1		5	0		10	1	1	3	0	1	8	0
300	11	10	9	1		7	2	1	3	0	1	10	3	2	6	0
400	15	7	8	1		10	0	1	8	0	2	6	0	3	4	1
500	19	4	7	1	1	0	2	2	1	0	3	1	3	4	2	1
600	23	1	6	2	1	3	0	2	6	0	3	9	1	5	0	1
700	26	18	5	2	1	5	2	2	11	1	4	4	3	5	10	1
800	30	15	4	3	1	8	0	3	4	1	5	0	1	6	8	1
900	34	12	3	3	1	10	3	3	9	1	5	7	3	7	6	2
1000	38	9	2	3	2	1	1	4	2	1	6	3	2	8	4	2
ditto	*l.* 38	46	1	54	*l.* .10467			*l.* .09352			*l.* .31401			*l.* .41868		

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal. l.	5 *Days.* s. d. q.	6 *Days.* s. d. q.	7 *Days.* s. d. q.	8 *Days.* s. d. q.	9 *Days.* s. d. q.
1		1	1	1	1
2	1	1	1	1	2
3	1	2	2	2	3
4	2	2	3	3	1 0
5	2	3	3	1 0	1 1
6	3	1 0	1 0	1 1	1 1
7	3	1 0	1 1	1 2	1 2
8	1 0	1 1	1 2	1 2	1 3
9	1 1	1 1	1 2	1 3	2 0
10	1 1	1 2	1 3	2 0	2 1
20	2 2	3 0	3 2	4 0	4 2
30	3 3	4 2	5 1	6 0	6 3
40	5 1	6 0	7 0	8 0	9 0
50	6 1	7 2	8 3	10 0	11 2
60	7 2	9 0	10 2	1 0 0	1 1 2
70	8 3	10 2	1 0 1	1 2 0	1 3 3
80	10 0	1 0 0	1 2 0	1 4 0	1 6 0
90	11 2	1 1 2	1 3 3	1 6 0	1 8 1
100	1 0 0	1 3 0	1 5 2	1 8 0	1 10 3
200	2 1 0	2 6 0	2 11 1	3 4 1	3 9 1
300	3 1 3	3 9 1	4 4 3	5 0 1	5 7 3
400	4 2 1	5 0 1	5 10 2	6 8 1	7 6 2
500	5 2 3	6 3 2	7 4 0	8 4 2	9 5 0
600	6 3 2	7 6 2	8 9 2	10 0 2	11 3 3
700	7 4 0	8 9 2	10 3 0	11 8 3	13 2 1
800	8 4 2	10 0 2	11 8 3	13 4 3	15 0 3
900	9 5 0	11 3 3	13 2 1	15 0 3	16 11 2
1000	10 5 2	12 6 3	14 7 3	16 9 0	18 10 0
ditto	*l.* .52335	*l.* .62802	*l.* .73269	*l.* .83737	*l.* .94204

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal. l.	1 *Day.* s. d. q.	2 *Days.* s. d. q.	3 *Days.* s. d. q.	4 *Days.* s. d. q.	5 *Days.* s. d. q.	6 *Days.* s. d. q.	7 *Days.* s. d. q.
1						1	1
2			1	1	1	1	2
3		1	1	1	2	2	3
4		1	1	2	2	3	3
5		1	2	2	3	1 0	1 0
6	1	1	2	3	1 0	1 1	1 1
7	1	2	3	3	1 1	1 1	1 2
8	1	2	3	1 0	1 1	1 2	1 3
9	1	2	3	1 1	1 2	1 3	2 0
10	1	3	1 0	1 1	1 3	2 0	2 1
20	3	1 1	2 0	2 3	3 1	4 0	4 2
30	1 0	2 0	3 0	4 0	5 0	5 3	6 3
40	1 1	2 2	4 0	5 1	6 2	7 3	9 1
50	1 3	3 1	5 0	6 2	8 1	9 3	11 2
60	2 0	4 0	6 0	7 3	10 0	11 3	1 1 3
70	2 1	4 3	6 3	9 1	11 2	1 1 3	1 4 1
80	2 3	5 1	7 3	10 2	1 1 0	1 3 3	1 6 1
90	3 0	6 0	8 3	11 3	1 2 3	1 5 3	1 8 3
100	3 1	6 2	9 3	1 1 0	1 4 2	1 7 3	1 11 0
200	6 2	1 1 0	1 7 3	2 2 1	2 8 3	3 3 2	3 10 0
300	10 0	1 7 3	2 5 3	3 3 2	4 1 1	4 11 0	5 9 0
400	1 1 1	2 2 1	3 3 2	4 4 3	5 5 3	6 6 3	7 8 0
500	1 4 2	2 8 3	4 1 1	5 5 3	6 10 0	8 2 2	9 7 0
600	1 7 3	3 3 2	4 11 1	6 6 3	8 2 2	9 10 1	11 6 0
700	1 11 0	3 10 0	5 9 0	7 8 0	9 7 0	11 6 0	13 5 0
800	2 2 1	4 4 3	6 6 3	8 9 1	10 11 2	13 1 2	15 4 0
900	2 5 3	4 11 1	7 4 3	9 10 1	12 3 3	14 9 1	17 3 0
1000	2 8 3	5 5 3	8 2 2	10 11 2	13 8 1	16 5 1	19 2 0
ditto	*l.* .1369	*l.* 2739	*l.* .4108	*l.* 5476	*l.* .6848	*l.* .8212	*l.* .9579

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal.	8 *Days.*				9 *Days.*				10 *Days.*				20 *Days.*				30 *Days.*				40 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1				1				1				1				3			1	0			1	1
2				2				2				2			1	1			2	0			2	2
3				3				3			1	0			2	0			3	0			4	0
4			1	0			1	1			1	1			2	3			4	0			5	1
5			1	1			1	2			1	3			3	1			5	0			6	2
6			1	2			1	3			2	0			4	0			6	0			7	3
7			1	3			2	0			2	1			4	3			6	3			9	1
8			2	0			2	1			2	3			5	1			7	3			10	2
9			2	1			2	3			3	0			6	0			8	3			11	3
10			2	3			3	0			3	1			6	2			9	3		1	1	0
20			5	1			5	3			6	2		1	1	0		1	7	2		2	2	0
30			7	3			8	3			10	0		1	7	2		2	5	2		3	3	1
40			10	2			11	3		1	1	0		2	2	1		3	3	1		4	4	1
50		1	1	0		1	2	3		1	4	2		2	8	3		4	1	0		5	5	1
60		1	3	3		1	5	3		1	7	3		3	3	1		4	11	0		6	6	2
70		1	6	1		1	8	3		1	11	0		3	10	0		5	8	3		7	7	2
80		1	9	0		1	11	3		2	2	1		4	4	2		6	6	2		8	8	2
90		1	11	3		2	2	2		2	5	2		4	11	0		7	4	2		9	9	3
100		2	2	1		2	5	2		2	8	3		5	5	2		8	2	1		10	10	3
200		4	4	2		4	11	0		5	5	3		10	11	1		16	4	2	1	1	9	2
300		6	6	3		7	4	3		8	2	2		16	4	3	1	4	6	3	1	12	8	1
400		8	9	0		9	10	1		10	11	2	1	1	10	1	1	12	9	0	2	3	7	0
500		10	11	2		12	3	3		13	8	0	1	7	4	0	2	0	11	0	2	14	6	0
600		13	1	2		14	9	1		16	5	0	1	12	9	2	2	9	1	1	3	5	5	0
700		15	4	0		17	2	3		19	1	3	1	18	3	0	2	17	3	2	3	16	3	3
800		17	6	0		19	8	2	1	1	10	3	2	3	8	2	3	5	5	3	4	7	2	1
900		19	8	2	1	2	2	0	1	4	7	2	2	9	2	1	3	13	8	0	4	18	1	0
1000	1	1	10	3	1	4	7	2	1	7	4	1	2	14	7	3	4	1	10	1	5	9	0	0
ditto	*l.* 1.0947				*l.* 1.2313				*l.* 1.3679				*l.* 2.7322				*l.* 4.0925				*l.* 5.4496			

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal l.	50 *Days.* l. s. d. q.	60 *Days.* l. s. d. q.	70 *Days.* l. s. d. q.	80 *Days.* l. s. d. q.	90 *Days.* l. s. d. q.	100 *Days.* l. s. d. q.
1	1 3	2 0	2 1	2 2	3 0	3 1
2	3 1	4 0	4 3	5 1	5 3	6 2
3	5 0	6 0	6 3	7 3	9 3	9 3
4	6 2	7 3	9 0	10 2	11 3	1 1 0
5	8 1	9 3	11 2	1 1 0	1 2 2	1 4 1
6	9 3	11 3	1 1 3	1 3 3	1 5 2	1 7 2
7	11 2	1 1 3	1 4 0	1 6 1	1 8 2	1 10 3
8	1 1 0	1 3 3	1 6 1	1 8 3	1 11 2	2 2 0
9	1 2 3	1 5 2	1 8 2	1 11 2	2 2 1	2 5 1
10	1 4 2	1 7 2	1 10 3	2 2 0	2 5 1	2 8 2
20	2 8 3	3 3 1	3 9 2	4 4 0	4 10 2	5 5 0
30	4 1 0	4 10 3	5 8 1	6 6 0	7 3 3	8 1 2
40	5 5 1	6 6 1	7 7 1	8 8 0	9 9 0	10 10 1
50	6 9 3	8 1 3	9 6 0	10 10 0	12 2 1	13 6 2
60	8 2 0	9 9 2	11 5 0	13 0 0	14 7 1	16 3 1
70	9 6 1	11 5 0	13 3 2	15 2 0	17 0 2	18 11 3
80	10 10 3	13 0 2	15 2 1	17 4 1	19 5 3	1 1 8 1
90	12 3 0	14 8 0	17 1 1	19 6 1	1 1 11 0	1 4 5 0
100	13 7 1	16 3 3	19 0 0	1 1 8 1	1 4 4 1	1 7 1 1
200	1 7 2 2	1 12 7 1	1 18 0 0	2 3 4 2	2 8 8 2	2 14 2 3
300	2 0 9 3	2 8 11 0	2 16 11 3	3 5 0 2	3 13 0 3	4 1 4 0
400	2 14 5 1	3 5 2 2	3 15 11 3	4 6 8 3	4 17 5 1	5 8 5 2
500	3 8 0 1	4 1 6 1	4 14 11 3	5 8 4 3	6 1 9 2	6 15 6 2
600	4 1 7 2	4 17 10 0	5 13 11 3	6 10 1 0	7 6 1 3	8 2 8 0
700	4 15 2 3	5 14 1 2	6 12 11 3	7 11 9 1	8 10 6 0	9 9 9 1
800	5 8 10 1	6 10 5 1	7 11 11 2	8 13 5 1	9 14 10 1	10 16 10 3
900	6 2 5 2	7 6 8 3	8 10 11 2	9 15 1 2	10 19 2 2	12 4 0 0
1000	6 16 0 3	8 3 0 2	9 9 11 2	10 16 9 3	12 3 7 0	13 10 1 1
ditto	*l.* 6.8027	*l.* 8.1521	*l.* 9.4976	*l.* 10.8401	*l.* 12.1786	*l.* 13.5 r.

A TABLE of DISCOUNT at 5 per Cent. per Ann.

Prin-cipal.	116 Days.				120 Days.				130 Days.				140 Days.				150 Days.				160 Days.			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			3	2			4	0			4	1			4	2			5	0			5	1
2			7	0			7	3			8	2			9	0			9	3			10	1
3			10	3			11	3		1	0	2		1	1	2		1	2	2		1	3	2
4		1	2	1		1	2	2		1	4	3		1	6	0		1	7	1		1	8	2
5		1	5	3		1	7	2		1	9	0		1	10	2		2	0	0		2	1	3
6		1	9	1		1	11	2		2	1	1		2	3	1		2	5	0		2	6	3
7		2	0	3		2	3	1		2	5	2		2	7	2		2	9	3		3	0	0
8		2	4	2		2	7	0		2	9	2		3	0	0		3	2	3		3	5	1
9		2	8	0		2	11	0		3	1	3		3	4	2		3	7	2		3	10	1
10		2	11	3		3	2	3		3	6	0		3	9	1		4	0	1		4	3	2
20		5	11	1		6	5	2		7	0	0		7	6	1		8	0	2		8	7	0
30		8	11	0		9	8	2		10	6	0		11	3	2		12	1	0		12	10	2
40		11	10	2		12	11	1		14	0	0		15	0	2		16	1	1		17	2	0
50		14	10	1		16	2	0		17	6	0		18	9	3	1	0	1	2	1	1	5	2
60		17	9	3		19	5	0	1	1	0	0	1	2	7	0	1	4	2	0	1	5	8	3
70	1	0	9	2	1	2	7	3	1	4	6	0	1	6	4	1	1	8	2	1	1	10	0	1
80	1	3	9	0	1	5	10	2	1	8	0	0	1	10	1	1	1	12	2	2	1	14	3	3
90	1	6	8	3	1	9	1	1	1	11	6	0	1	13	10	2	1	16	3	0	1	18	7	1
100	1	9	8	1	1	12	4	1	1	15	0	0	1	17	7	2	2	0	3	1	2	2	10	3
200	2	19	4	3	3	4	8	1	3	9	11	3	3	15	3	1	4	0	6	2	4	5	9	2
300	4	9	0	3	4	17	0	1	5	4	11	3	5	12	11	0	6	0	9	3	6	8	8	1
400	5	18	9	0	6	9	4	3	6	19	11	3	7	10	6	2	8	1	0	3	8	11	7	0
500	7	8	5	1	8	1	8	3	8	14	11	2	9	8	2	0	10	1	4	1	10	14	5	3
600	8	18	1	2	9	14	0	3	10	9	11	2	11	5	9	3	12	1	7	1	12	17	4	2
700	10	7	10	0	11	6	5	0	12	4	11	2	13	3	5	1	14	1	10	2	15	0	3	1
800	11	17	6	1	12	18	9	1	13	19	11	2	15	1	1	0	16	2	1	3	17	3	2	0
900	13	7	2	2	14	11	1	1	15	14	11	1	16	18	8	2	18	2	5	0	19	6	0	3
1000	14	16	10	3	16	3	5	2	17	9	11	1	18	16	4	1	20	2	8	1	21	8	11	2
	l. 14.8448				*l.* 16.1725				*l.* 17.4966				*l.* 18.8172				*l.* 20.1342				*l.* 21.4477			

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal. l.	170 *Days.* l. s. d. q	180 *Days.* l. s. d. q.	190 *Days.* l. s. d. q.	200 *Days.* l. s. d. q.	210 *Days.* l. s. d. q.	220 *Days.* l. s. d. q.
1	5 2	5 3	6 0	6 2	6 3	7 0
2	11 0	11 2	1 0 0	1 0 3	1 1 2	1 2 0
3	1 4 2	1 5 1	1 6 1	1 7 1	1 8 1	1 9 0
4	1 10 0	1 11 0	2 0 1	2 1 2	1 2 3	2 4 1
5	2 3 1	2 5 0	2 6 2	2 8 1	1 9 2	2 11 0
6	2 8 3	2 10 3	3 0 2	3 2 2	3 4 2	3 6 1
7	3 2 1	3 4 2	3 6 3	3 8 3	3 11 0	4 1 1
8	3 7 3	3 10 1	4 0 3	4 3 1	4 5 3	4 8 1
9	4 1 0	4 4 0	4 6 3	4 9 3	5 0 1	5 3 1
10	4 6 3	4 9 3	5 1 0	5 4 0	5 7 0	5 10 1
20	9 1 1	9 7 2	10 1 3	10 8 0	11 2 1	11 8 2
30	13 7 3	14 5 1	15 2 3	16 0 0	16 9 1	17 6 2
40	18 2 2	19 3 0	1 0 3 2	1 1 4 0	1 2 4 2	1 3 5 0
50	1 2 9 0	1 4 0 3	1 5 4 2	1 6 8 0	1 7 11 3	1 9 3 0
60	1 7 3 3	1 8 10 2	1 10 5 2	1 12 0 0	1 13 6 3	1 15 1 1
70	1 11 10 0	1 13 8 1	1 15 6 1	1 17 4 0	1 19 1 3	2 0 11 2
80	1 16 5 0	1 18 6 0	2 0 7 0	2 2 8 0	2 4 9 0	2 6 9 3
90	2 0 11 2	2 3 3 3	2 5 8 0	2 8 0 0	2 10 4 0	2 12 8 0
100	2 5 6 1	2 8 1 2	2 10 8 3	2 13 4 0	2 15 11 1	2 18 6 0
200	4 11 0 1	4 16 3 0	5 1 5 2	5 6 8 0	5 11 10 1	5 17 0 1
300	6 16 6 2	7 4 4 3	7 12 2 2	8 0 0 0	8 7 9 1	8 15 6 2
400	9 2 0 3	9 12 6 1	10 2 11 1	10 13 4 0	11 3 8 2	11 14 0 2
500	11 7 7 0	12 0 7 3	12 13 8 0	13 6 8 0	13 19 7 2	14 12 6 2
600	13 13 1 0	14 8 9 1	15 4 5 0	16 0 0 0	16 15 6 3	17 11 0 3
700	15 18 7 1	16 16 10 3	17 15 1 3	18 13 4 0	19 11 5 3	20 9 7 0
800	18 4 1 2	19 5 0 1	20 5 10 2	21 6 8 0	22 7 2 2	23 8 1 0
900	20 9 7 3	21 13 1 3	22 16 7 1	24 0 0 0	25 3 4 0	26 6 7 0
1000	22 15 1 3	24 1 3 2	25 7 4 1	26 13 4 0	27 19 3 1	29 5 1 1
ditto	*l.* 22.7577	*l.* 24.06420	*l.* 25.36710	*l.* 26.6 r 1	*l.* 27.9627	*l.* 29.2553

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal.	230 *Days.*				240 *Days.*				250 *Days.*				260 *Days.*				270 *Days.*				280 *Days.*			
l.	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1			7	1			7	2			8	0			8	1			8	2			8	3
2		1	2	3		1	3	1		1	4	0		1	4	2		1	5	1		1	5	3
3		1	10	0		1	11	0		1	11	3		2	0	3		2	1	3		2	2	2
4		2	5	1		2	6	2		2	7	3		2	9	0		2	10	1		2	11	2
5		3	0	3		3	2	1		3	3	3		3	5	1		3	6	3		3	8	1
6		3	8	0		3	9	3		3	11	3		4	1	2		4	3	2		4	5	1
7		4	3	1		4	5	2		4	7	2		4	9	3		5	0	0		5	2	0
8		4	10	2		5	1	0		5	3	2		5	6	0		5	8	2		5	11	0
9		5	6	0		5	8	3		5	11	2		6	2	1		6	5	0		6	7	3
10		6	1	1		6	4	2		6	7	2		6	10	2		7	1	2		7	4	3
20		12	2	2		12	8	3		13	3	0		13	9	0		14	3	1		14	9	1
30		18	4	0		19	1	1		19	10	2	1	0	7	2	1	1	5	0	1	2	2	0
40	1	4	5	1	1	5	5	2	1	6	6	0	1	7	6	0	1	8	6	2	1	9	6	3
50	1	10	6	2	1	11	10	0	1	13	1	1	1	14	4	3	1	15	8	0	1	16	11	1
60	1	16	7	3	1	18	2	1	1	19	8	3	2	1	3	1	2	2	9	2	2	4	4	0
70	2	2	9	1	2	4	6	3	2	6	4	1	2	8	1	3	2	9	11	1	2	11	8	2
80	2	8	10	2	2	10	11	1	2	12	11	3	2	15	0	1	2	17	0	3	2	19	1	1
90	2	14	11	3	2	17	3	2	2	19	7	1	3	1	11	0	3	4	2	2	3	6	6	0
100	3	1	1	0	3	3	8	0	3	6	2	3	3	8	9	2	3	11	4	0	3	13	10	2
200	6	2	2	0	6	7	4	0	6	12	5	2	6	17	6	3	7	2	8	0	7	7	9	0
300	9	3	3	1	9	10	11	3	9	18	8	0	10	6	4	1	10	14	0	0	11	1	7	2
400	12	4	4	2	12	14	7	3	13	4	10	3	13	15	1	2	14	5	4	0	14	15	6	0
500	15	5	5	1	15	18	3	3	16	11	1	2	17	3	6	1	17	16	8	0	18	9	4	3
600	18	6	6	2	19	1	11	2	19	17	4	1	20	12	8	1	21	8	0	0	22	3	3	1
700	21	7	7	2	22	5	7	2	23	3	7	0	24	1	5	3	24	19	4	0	25	17	1	3
800	24	8	8	2	25	9	3	2	26	9	9	2	27	10	3	1	28	10	8	0	29	11	0	1
900	27	9	9	2	28	12	11	1	29	16	0	1	30	19	0	2	32	2	0	0	33	4	11	0
1000	30	10	10	3	31	16	7	1	33	2	3	0	34	7	10	0	35	13	4	0	36	18	9	2
ditto	*l.* 30.5444				*l.* 31.8302				*l.* 33.1125				*l.* 34.3915				*l.* 35.6671				*l.* 36.9393			

A TABLE *of* DISCOUNT *at 5 per Cent. per Ann.*

Principal l.	290 *Days.* l. s. d. q	300 *Days.* l. s. d. q.	310 *Days.* l. s. d. q.	320 *Days.* l. s. d. q.	330 *Days.* l. s. d. q.	340 *Days.* l. s. d. q.
1	9 1	9 2	9 3	10 0	10 2	10 3
2	1 6 1	1 7 0	1 7 2	1 8 0	1 8 3	1 9 1
3	2 3 2	2 4 2	2 5 1	2 6 1	2 7 1	2 8 0
4	3 0 3	3 1 3	3 3 0	3 4 2	3 5 2	3 6 3
5	3 10 0	3 11 2	4 0 3	4 2 2	4 4 0	4 5 2
6	4 7 0	4 8 3	4 10 3	5 0 2	5 2 1	5 4 1
7	5 4 1	5 6 1	5 8 2	5 10 2	6 0 3	6 2 3
8	6 1 1	6 3 3	6 6 1	6 8 2	6 11 0	7 1 2
9	6 10 2	7 1 1	7 4 0	7 6 3	7 9 2	8 0 0
10	7 7 3	7 10 3	8 1 3	8 5 0	8 7 3	8 11 0
20	15 3 2	15 9 2	16 3 2	16 9 2	17 3 3	17 9 3
30	1 2 11 0	1 3 8 1	1 4 5 1	1 5 2 1	1 5 11 2	1 6 8 2
40	1 10 6 3	1 11 7 0	1 12 7 0	1 13 7 0	1 14 7 1	1 15 7 1
50	1 18 2 2	1 19 5 3	2 0 8 3	2 2 0 0	2 3 3 0	2 4 6 0
60	2 5 10 1	2 7 4 2	2 8 10 3	2 10 4 3	2 11 13 3	2 13 4 3
70	2 13 6 0	2 15 3 1	2 17 0 1	2 18 9 2	3 0 6 2	3 2 3 3
80	3 1 1 2	3 3 2 0	3 5 2 0	3 7 2 1	3 9 2 2	3 11 2 2
90	3 8 9 1	3 11 0 2	3 13 4 0	3 15 7 0	3 17 10 1	4 0 1 1
100	3 16 5 0	3 18 11 2	4 1 5 3	4 3 11 3	4 6 6 0	4 9 0 0
200	7 12 10 0	7 17 10 3	8 2 11 2	8 7 11 3	8 13 0 0	8 18 0 0
300	11 9 3 0	11 16 10 1	12 4 5 0	12 11 11 3	12 19 6 0	13 7 0 0
400	15 5 8 0	15 15 9 2	16 5 10 3	16 15 11 2	17 6 0 0	17 16 0 1
500	19 2 1 0	19 14 8 3	20 7 4 1	20 19 11 2	21 12 6 0	22 5 0 1
600	22 18 6 0	23 13 8 1	24 8 10 0	25 3 11 1	25 19 0 0	26 14 0 1
700	26 14 11 0	27 12 7 2	28 10 3 3	29 7 11 0	30 5 6 0	31 3 0 2
800	30 11 4 0	31 11 7 0	32 11 9 1	33 11 11 0	34 12 0 0	35 12 0 2
900	34 7 9 0	35 10 6 1	36 13 3 0	37 15 11 0	38 18 6 0	40 1 0 2
1000	38 4 2 0	39 9 5 3	40 14 8 2	41 19 10 3	43 5 0 0	44 10 0 2
ditto	*l.* 38.2081	*l.* 39.4736	*l.* 40.7358	*l.* 41.9947	*l.* 43.2503	*l.* 44.5026

Discount at 5 per Cent.

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal l.	350 *Days.*				360 *Days.*				365 *Days.*				1 *Day.*			2 *Days.*			3 *Days.*		
	l.	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*
1		11	0			11	1			11	1										
2		1	10	0		1	10	2		1	11	0									1
3		2	9	0		2	9	3		2	10	1					1				1
4		3	8	0		3	9	1		3	9	2					1				1
5		4	7	0		4	8	2		4	9	0					1				2
6		5	6	0		5	7	3		5	8	2			1		1				2
7		6	5	0		6	7	0		6	8	0			1		2				3
8		7	4	0		7	6	1		7	7	2			1		2				3
9		8	3	0		8	5	2		8	6	3			1		2				3
10		9	2	0		9	4	3		9	6	1			1		2			1	0
20		18	3	3		18	9	2		19	0	2			2		1	1		2	0
30	1	7	5	2	1	8	2	2	1	8	6	3		1	0		1	3		2	3
40	1	16	7	1	1	17	7	1	1	18	1	1		1	1		2	1		3	3
50	2	5	9	0	2	7	0	0	2	7	7	2		1	2		3	1		4	3
60	2	14	10	3	2	16	4	3	2	17	1	3		1	3		3	3		5	2
70	3	4	0	2	3	5	9	2	3	6	8	0		2	1		4	2		6	2
80	3	13	2	2	3	15	2	2	3	16	2	1		2	2		5	0		7	2
90	4	2	4	1	4	4	7	1	4	5	8	2		3	0		5	3		8	2
100	4	11	6	0	4	14	0	0	4	15	2	3		3	1		6	1		9	1
200	9	3	0	0	9	7	11	3	9	10	5	3		6	1	1	0	2	1	6	3
300	13	14	6	0	14	1	11	3	14	5	8	2		9	2	1	6	3	2	4	1
400	18	6	0	0	18	15	11	3	19	0	11	2	1	0	2	2	1	0	3	1	2
500	22	17	6	1	23	9	11	3	23	16	2	1	1	3	3	2	7	1	3	11	0
600	27	9	0	1	28	3	11	2	28	11	5	1	1	6	3	3	1	2	4	8	1
700	32	0	6	1	32	17	11	2	33	6	8	0	1	10	0	3	7	3	5	5	3
800	36	12	0	1	37	11	11	2	38	1	11	0	2	1	0	4	2	0	6	3	1
900	41	3	6	1	42	5	11	2	42	17	1	3	2	4	1	4	8	1	7	0	2
1000	45	15	0	1	46	19	11	1	47	12	4	3	2	7	1	5	2	2	7	9	3
ditto	*l.* 45.7516				*l.* 46.9973				*l.* 47.619				*l.* 0.1304			*l.* 0.2608			*l.* 0.3912		

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal.	4 *Days.*			5 *Days.*			6 *Days.*			7 *Days.*			8 *Days.*				9 *Days.*			
l.	*s.*	*d.*	*q.*	*s.*	*d.*	*q.*	*s.*	*d.*	*q*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
1						0			1			1				1				1
2			1			1			1			2				2				2
3			1			2			2			3				3				3
4			2			2			3			3			1	0			1	0
5			2			3		1	0		1	0			1	1			1	2
6			3		1	0		1	0		1	1			1	2			1	3
7			3		1	0		1	1		1	2			1	3			2	0
8		1	0		1	1		1	2		1	3			2	0			2	1
9		1	0		1	2		1	3		2	0			2	1			2	2
10		1	1		1	2		2	0		2	1			2	2			3	0
20		2	2		3	1		3	3		4	2			5	0			5	3
30		3	3		4	3		5	3		6	2			7	2			8	2
40		5	0		6	1		7	2		8	3			10	0			11	1
50		6	1		7	3		9	2		11	0		1	0	2		1	2	0
60		7	2		9	2		11	1	1	1	1		1	3	0		1	5	0
70		8	3		11	0	1	1	1	1	3	1		1	5	2		1	7	3
80		10	0	1	0	2	1	3	0	1	5	2		1	8	0		1	10	2
90		11	1	1	2	0	1	5	0	1	7	3		1	10	2		2	1	1
100	1	0	2	1	3	3	1	6	3	1	10	0		2	1	0		2	4	1
200	2	1	0	2	7	1	3	1	2	3	7	3		4	2	0		4	8	1
300	3	1	2	3	11	0	4	8	1	5	5	3		6	3	0		7	0	2
400	4	2	0	5	2	2	6	3	1	7	3	3		8	4	0		9	4	3
500	5	2	2	6	6	1	7	10	0	9	1	2		10	5	1		11	8	3
600	6	3	1	7	10	0	9	4	3	10	11	2		12	6	1		14	1	0
700	7	3	3	9	1	2	10	11	2	12	9	1		14	7	1		16	5	1
800	8	4	1	10	5	1	12	6	1	14	7	1		16	8	1		18	9	1
900	9	4	3	11	8	3	14	1	0	16	5	1		18	9	1	1	1	1	2
1000	10	5	1	13	0	2	15	7	3	18	3	0	1	0	10	1	1	3	5	3
ditto	*l.* 0.5216			*l.* 0.652			*l.* 0.7824			*l.* 0.9128			*l.* 1.0432				*l.* 1.1736			

The Use of the Tables of Discount foregoing.

Q. 1. What is the Discount of *l.* 700 (if paid 137 days before due) at 4 *per Cent?*

In the 1st Table against *l.* 700, under 130 days is *l.* 9 : 16 : 7½

700 under 7 days (part the 2d, at the end of the Table) — : 10 : 3

Sum, or Answer — = *l.* 10 : 6 : 10½

Q. 2. What is the Discount of *l.* 1500 for 57 Days at 5 *per Cent?*

By the Method in the Margin, the Answer is found *l.* 11 : 11 : 5½.

I shall give another Example, which takes in all the Varietys of the Use of the Table.

Example 2.] What Discount at 5 *per Cent.* is to be allow'd, to satisfy a Debt of *l.* 5000, 91 Days before the same is due?

l.	*Days.*	
1000 for 50	=	*l.* 6 : 16 : 0¾
500	—	3 : 8 : 0¼
1000 for 7	=	0 . 19 : 2
500	—	0 : 9 : 1½

l. 11 : 12 : 4½ = *Sum*

Note, That for 1, 2, 3, 4, 5, 6, 7, 8, and 9 Days, from and above 90, &c. to 360; I take those Tabular Numbers against 1, 2, *&c.* to 9, at the end of the Table of Discount.

l.	*Days.*	
Against 1000 (or ditto) under 90 stands		12.1786
And under 1 (part 2.)	=	0.1304 add.
Sum	=	12.3090.
Which multiply by the Thousands —	=	5
The Answer or Product	=	61.545 = *l.* 61 : 10 : 11;

But had this Question been done by the Tables in Dr. *Harris's Lexicon*, which he says are accurate; it will be found *l.* 2 : 5 : 4½ too little. For 91 Days multiplied in *l.* 5000 gives 455000. And by those Tables you have against 400000 = 52.1853

50000 = 6.5232

5000 = 0.6523

Sum = 59.3608 = *l.* 59 : 7 : 2½

Which taken from my Discount above, is too little by *l.* 2 : 3 : 8½ as I have fully proved before the Tables above.

III. *Of Compound Interest: The Use of Decimals.*

I have shew'd above, what Compound Interest is, and now proceed to give the Reader the Use of Decimals in computing thereof.

Case 1. To find the Amount of any Sum of Money for any Number of Years, as of *l.* 650 for 5 Years at 5 *per Cent. per Ann.* Compound Interest.

Rule.] First find the Amount of *l.* 1 for 5 Years, and multiply the 5th Year by *l.* 650, the Principal given, thus:

Example.] 1st, 100. 105 :: 1. 1.05 = at the end of 1 Year.

2dly, 100. 105 :: 1.05
105

3dly, 100. 105 :: 1.1025 = of the 2d Year.
105

4thly, 100. 105 :: 1.157625 = of the 3d Year.
105

5thly, 100. 105 :: 1.21550625 = the 4th Year.
105

Answer = 1.276281562**5** = 5th Year.
650 multiply.

The Amount of *l.* 650 for 5 Years = 829.5830156 = Answer.

Or it will be the same thing to multiply the 3d Number by 1.05 continually; *i. e.* to multiply the Surfolid of 1.05 by 650.

In this Example you see that every Year requires a Multiplication performed as *per Compend.* 2. of Multiplication of Decimals, and the last by the 650, as *per Compend.* 6. whereby 'tis found, that if *l.* 650 be put out and forborn 5 Years, the Interest of that Principal, and of the Interest accruing, will amount to *l.* 829 : 11 : 8.

Case 2. To find the present Worth of any Sum due any Number of Years hence, as of *l.* 829 : 11 : 8 (or *l.* 829.5830156**25**) due at the end of 5 Years. See the Operation at 5 *per Cent.* Compound Interest, or divide the Number given, &c. by 1.05. continually.

1.05.

1.05. 100 :: 829.5, &c.

1.05) 82958.3015625 (790.976200595 = 1 Year hence.
945
800
651
210
625
1000
550

105) 79007.620059500 (752.453524376
... Worth 2 Year hence. | 25
550
257
476
562
370
550
255
459
395
800
650

3dly, 105. 100 :: 752.453524376. 716.622423 = 3 Years hence.
4thly, 105. 100 :: 716.622423. 682.497164 = preſent Worth 4 Years hence.
5thly, 105. 100 :: 682.497164. 650. = the preſent Worth of the Sum given, viz. l. 829 : 11 : 8 due at the end of 5 Years.

Here you may obſerve, that the 4th Proportional is always the 3d Number in the Proportion the next ſtating: And having for every Year multiplied by 100, and divided by 105, and the propoſed Rate of Intereſt, (directly contrary to what you did in the laſt Caſe) the 4th Proportional in the 5th Operation is l. 650, which is the

the present Worth of *l.* 829 : 11 : 8, due at the end of 5 Years; which proves the Truth of the last Case.

And after the same manner, had you desired to have found the present Worth of *l.* 1 due 5 Years hence, the several Years Decrease would be as in the following Table, Column 2. from that of Years.

Years.	*The Amount of* l. 1.	*The present Worth of* l. 1.	*The Amount of* l. 1. *Annuity.*	*The present Worth of* l. 1. *Annuity.*
1	1.05	.95238095	1	.95238095
2	1.1025	.90702947	2.05	1.85941042
3	1.157625	.86383759	3.1525	2.72324801
4	1.21550625	.82270247	4.310125	3.54595048
5	1.27628156	.78352616	5.52563125	4.32947664

Case 3. To find the Amount of Annuitys forborn any Number of Years, you will easily consider, that at the end of 1 Year there is 1 Year's Income due without any Interest; for the 2d Year, at the end of that, there is 2 Years Income due, and the Interest of 1 Year; at the end of the 3d Year, there is due 3 Years Income; 2 Years Interest of the 1st Year's Income, 1 Year's Interest of the 2d Year's Income, and 1 Year's Interest of the Interest of the 1st Year's Income, *&c.*

Thus suppose the Rent 1 *l per ann.* the 3 Years Income is *l.* 3
2 Years Interest of the 1st Year's Income = 0.1
1 Years Interest of the 2d Year's Income = 0.05
And 1 Year's Interest of the Interest of the 1st Year's Income = 0.0025

The Sum is the utmost Improvement of this Annuity for 3 Years, *viz.* = 3.1525

Hence it follows, that a Table of the Amount of 1 *l.* Annuity, as the 3d Column above is made from the Column of the Amount of *l.* 1, by making the Tabular Number for the 1st Year 1; for the 2d in the 3d Column the Sum of the 2 first Numbers in the 1st and 3d Columns; the 3d Number in the 3d Column is the Sum of the 2d Number in the 1st and 3d Columns, *&c.*

Case

Case 4. To find the present Worth of an Annuity due any Number of Years to come, it must be considered that the present Worth of 1 *l.* Annuity to continue 1 Year is the same with the present Worth of *l.* 1 due a Year hence. So that the present Worth of an Annuity to continue 2 Years, is the Sum of the present Worth thereof for 1 Year, and the present Worth of the like Sum with the Annuity to continue 2 Years; and thus the 4th Column in the above Tablet is made: For

	Nº	*Col.*	
The 1 in the 4 is	.95238095	} Sum =	the 2d in Col. 4.
2 —— 2 —	.90702947	}	*viz.* 1.85941042.
2 —— 4 —	1.85941042	} Sum =	the 3d in Col. 4.
3 —— 2 —	.86383759	}	*viz.* 2.72324801, *&c.*

Case 5. To find what Annuity, to continue any Number of Years, any Sum will purchase. Divide a Unit by any of the Numbers which are the present Worth of *l.* 1 Annuity for any Years, and the Quotient shews the Annuity that 1 *l.* will purchase to continue those Years. Thus if I would know what *l.* 1 will purchase *per ann.* to continue 5 Years:

As 4.32947664. 1 :: 1. .23097480 = Answ. = 4 *s.* 7 *d.* $\frac{1}{2}$ (*per ann.*

Farther Rules concerning the five Cases above.

1. To enlarge the Numbers tabulated above, and what is under the 5th Case, to any Number of Years, two ways.

2. How to use them for any other Sum, above *l.* 1.

1. You may augment the first and second Columns by several Operations, as taught above, from 5 Years to 50, *&c.* and from them may make the third and fouth Columns, and another shewing what *l.* 1 will purchase to continue those Years.

Or, because the Numbers in the 1st Column of Compound Interest are in proportion as 100 to 105, or as 1 to 1.05, therefore that Column is a Series in Geometrical Proportion, whose Ratio is 1 05, so that (as in *Progression*, Sect. 2. Chap. 2.) if you have no occasion for the intermediate Numbers, but would know the Amount, present Worth of any Sum or Annuity, *&c.* for 41 Years; for the Amount of *l.* 1 multiply the 1.27628156 by itself, and it produceth the Amount for 10 Years; which if you multiply by itself, produceth the Amount for 20 Years; and that multiplied by itself, produceth the Amount for 40 Years. And having done the like

With the the 2d Column (of the present Worth of *l.* 1) and found the present Worth for 40 Years; you may easily by the Rules under the first and second Case find the Amount or present Worth for one Year more. And having those two for 40 and 41 Years, you may easily from thence calculate the Amount, present Worth, or Purchase of Annuitys, as is shew'd under the 3d, 4th and 5th Cases.

2. For Sums of Money or Annuitys above *l.* 1, you have nothing to do but to multiply respectively by such Pounds: Thus for *l.* 500 5 Years,

l.

If you multiply 1.27628156 by 500 you have the Amount of (*l.* 500, 5 Years.

.78352616 by 500, you have the present (Worth of *l.* 500 due 5 Years hence.

5.52563125 by 500, you have the Amount of (*l.* 500 *per ann.* for 5 Years.

4.32947664 by 500, you have the present (Worth of *l.* 500 *per ann.* to continue 5 Years.

And as in Case 5. .2309748 by 500, you have the Annuity that (*l.* 500 will purchase to continue 5 Years.

And the like for any other Sums or Terms of Years.

But all these things (if you are without Tables of Interest) are most easily and concisely done by the Logarithms, as appears in that Part of Arithmetic hereafter following.

Compound

COMPOUND INTEREST *at 3 per Cent.*

Years.	TABLE I. *The Amount of* 1.1.	TABLE II. *The preſent Worth of* 1. 1.	TABLE III. *The Amount of* 1.1 *Annuity.*	TABLE IV. *The preſent Worth of* 1.1 *Annuity.*
1	1.03	.9708738	1	.9708738
2	1.0609	.9425959	2.03	1.9134697
3	1.092727	.9151417	3.0909	2.8286114
4	1.1255088	.8884870	4.183627	3.7170984
5	1.1592741	.8626088	5.3091358	4.5797072
6	1.1940523	.8374843	6.4684099	5.4171914
7	1.2298739	.8130915	7.6624622	6.2302829
8	1.2667701	.7894092	8.8923360	7.0196922
9	1.3047732	.7664167	10.1591061	7.7861089
10	1.3439164	.7440939	11.4638793	8.5302028
11	1.3842339	.7224213	12.8077957	9.2526241
12	1.4257609	.7013799	14.1920296	9.9540040
13	1.4685337	.6809513	15.6177904	10.6349553
14	1.5125897	.6611178	17.0863242	11.2960731
15	1.5579674	.6418619	18.5989139	11.9379351
16	1.6047064	.6231669	20.1568813	12.5611020
17	1.6528476	.6050164	21.7615877	13.1661185
18	1.7024331	.5873946	23.4144354	13.7535131
19	1.7535061	.5702860	25.1168684	14.3237991
20	1.8061112	.5536758	26.8703745	14.8774748
21	1.8602946	.5375493	28.6764857	15.4150241
22	1.9161034	.5218925	30.5367803	15.9369166
23	1.9735865	.5066917	32.4528837	16.4436084
24	2.0327941	.4919337	34.4264702	16.9355421
25	2.0937779	.4776056	36.4592643	17.4131477
26	2.1565913	.4636947	38.5530422	17.8768420
27	2.2212890	.4501891	40.7096335	18.3270315
28	2.2879277	.4370768	42.9309225	18.7641082
29	2.3565655	.4243464	45.2188502	19.1884546
30	2.4272625	.4119868	47.5754157	19.6004413
31	2.5000803	.3999871	50.0026782	20.0004285

COMPOUND INTEREST *at* 3 *per Cent.*

Years.	TABLE I. Continu'd. *The Amount of* l. 1.	TABLE II. Continu'd. *The present Worth of* l. 1.	TABLE III. Continu'd. *The Amount of* l. 1 *Annuity.*	TABLE IV. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	2.5750828	.3883370	52.5027585	20.3887655
33	2.6523352	.3770262	55.0778413	20.7657918
34	2.7319053	.3660449	57.7301765	21.1318367
35	2.8138624	.3553834	60.4620818	21.4872200
36	2.8982783	.3450324	63.2759443	21.8322525
37	2.9852267	.3349829	66.1742226	22.1672354
38	3.0747835	.3252262	69.1594493	22.4924616
39	3.1670270	.3157535	72.2342327	22.8082151
40	3.2620378	.3065568	75.4012597	23.1147719
41	3.3598989	.2976280	78.6632975	23.4123999
42	3.4606959	.2889592	82.0231964	23.7013592
43	3.5645168	.2805429	85.4838923	23.9819021
44	3.6714523	.2723718	89.0484091	24.2542739
45	3.7815959	.2644386	92.7198614	24.5187125
46	3.8950437	.2567365	96.5014572	24.7754490
47	4.0118950	.2492588	100.3965009	25.0247078
48	4.1322519	.2419988	104.4083960	25.2667066
49	4.2562194	.2349503	108.5406479	25.5016569
50	4.3839060	.2281071	112.7968673	25.7297640
51	4.5154232	.2214632	117.1807733	25.9512271
52	4.6508859	.2150128	121.6961966	26.1662399
53	4.7904125	.2087503	126.3470825	26.3749902
54	4.9341249	.2026702	131.1374949	26.5776040
55	5.0821486	.1967672	136.0716198	26.7744276
56	5.2346131	.1910361	141.1537684	26.9654637
57	5.3916515	.1854719	146.3883815	27.1509356
58	5.5534010	.1800698	151.7800329	27.3310054
59	5.7200030	.1748251	157.3334339	27.5058305
60	5.8916031	.1697331	163.0534369	27.6755636
61	6.0683512	.1647894	168.9450400	27.8403530

COMPOUND INTEREST *at 4 per Cent.*

Years.	TABLE V. *The Amount of* l. 1.	TABLE VI. *The preſent Worth of* l. 1.	TABLE VII. *The Amount of* l. 1 *Annuity.*	TABLE VIII. *The preſent Worth of* l. 1 *Annuity.*
1	1.04	.9615385	1.0	.9615385
2	1.0816	.9245562	2.04	1.8860947
3	1.124864	.8889964	3.1216	2.7750910
4	1.16985 86	.8548042	4.246464	3.6298952
5	1.2166529	.8219271	5.4163226	4.4518223
6	1.2653190	.7903145	6.6329755	5.2421369
7	1.3159318	.7599178	7.8982945	6.0020547
8	1.3685691	.7306901	9.2142263	6.7327448
9	1.4233118	.7025866	10.5827953	7.4353314
10	1.4802443	.6755641	12.0061071	8.1108955
11	1.5394541	.6495808	13.4863514	8.7604763
12	1.6010322	.6245970	15.0258055	9.3850733
13	1.6650735	.6005740	16.6268377	9.9856473
14	1.7316764	.5774750	18.2919112	10.5631223
15	1.8009435	.5552644	20.0235876	11.1183868
16	1.8729812	.5339081	21.8245311	11.6522949
17	1.9479005	.5133732	23.6975124	12.1656680
18	2.0258165	.4936281	25.6454129	12.6592961
19	2.1068492	.4746424	27.6712294	13.1339385
20	2.1911231	.4563869	29.7780786	13.5903253
21	2.2787681	.4388335	31.9692017	14.0291589
22	2.3699188	.4219553	34.2479698	14.4511142
23	2.4647155	.4057263	36.6178886	14.8568405
24	2.5633042	.3901214	39.0826041	15.2469619
25	2.6658363	.3751168	41.6459083	15.6220787
26	2.7724698	.3606892	44.3117446	15.9827678
27	2.8833686	.3468165	47.0842144	16.3295844
28	2.9987033	.3334774	49.9675830	16.6630618
29	3.1186515	.3206514	52 9662863	16 9837132
30	3.2433975	.3083186	56.0849377	17.2920318
31	3.3731334	.2964602	59.3283352	17.5884921

COMPOUND INTEREST *at* 4 *per Cent.*

Years.	TABLE V. Continu'd. *The Amount of* l. 1.	TABLE VI. Continu'd. *The present Worth of* l. 1.	TABLE VII. Continu'd. *The Amount of* l. 1 *Annuity.*	TABLE VIII. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	3.5080587	.2850579	62.7014687	17.8735500
33	3.6483811	.2740941	66.2095274	18.1476441
34	3.7943163	.2635521	69.8579045	18.4111962
35	3.9460890	.2534154	73.6522248	18.6646116
36	4.1039326	.2436687	77.5983138	18.9082803
37	4.2680899	.2342968	81.7022464	19.1425771
38	4.4388134	.2252854	85.9703362	19.3678625
39	4.6163660	.2166206	90.4091497	19.5844831
40	4.8010206	.2082890	95.0255157	19.7927721
41	4.9930615	.2002779	99.8265363	19.9930500
42	5.1927839	.1925749	104.8195978	20.1856250
43	5.4004953	.1851682	110.0123817	20.3707931
44	5.6165151	.1780463	115.4128769	20.5488395
45	5.8411757	.1711984	121.0293920	20.7200378
46	6.0748227	.1646138	126.8705677	20.8846517
47	6.3178156	.1582825	132.9453904	21.0429342
48	6.5705282	.1521947	139.2632060	21.1951289
49	6.8333494	.1463411	145.8337342	21.3414700
50	7.1066833	.1407126	152.6670836	21.4821826
51	7.3909507	.1353006	159.7737670	21.6174832
52	7.6865887	.1300967	167.1647176	21.7475800
53	7.9940522	.1250930	174.8513063	21.8726729
54	8.3138143	.1202817	182.8453586	21.9929546
55	8.6463669	.1156555	191.1591729	22.1086100
56	8.9922216	.1112072	199.8055398	22.2198172
57	9.3519105	.1069300	208.7977614	22.3267472
58	9.7259869	.1028173	218.1496719	22.4295645
59	10.1150263	.0988628	227.8756588	22.5284273
60	10.5196274	.0950604	237.9906851	22.6234877
61	10.9404125	.0914042	248.5103125	22.7148919

COMPOUND INTEREST *at 5 per Cent.*

Years.	TABLE IX. *The Amount of* 1. 1.	TABLE X. *The present Worth of* 1. 1.	TABLE XI. *The Amount of* 1. 1 *Annuity.*	TABLE XII. *The present Worth of* 1. 1 *Annuity.*
1	1.05	.9523809	1.0	.9523809
2	1.1025	.9070294	2.05	1.8594103
3	1.157625	.8638376	3.1525	2.7232480
4	1.2155063	.8227025	4.310125	3.5459505
5	1.2762816	.7835262	5.5256312	4.3294767
6	1.3400956	.7462154	6.8019128	5.0756921
7	1.4071064	.7106813	8.1420084	5.7863734
8	1.4774554	.6768394	9.5491089	6.4632128
9	1.5513282	.6446089	11.0265643	7.1078217
10	1.6288946	.6139133	12.5778925	7.7217349
11	1.7103393	.5846929	14.2067871	8.3064142
12	1.7958563	.5568374	15.9171265	8.8632516
13	1.8856491	.5303213	17.7129828	9.3935730
14	1.9799316	.5050680	19.5986320	9.8986409
15	2.0789282	.4810171	21.5785636	10.3796580
16	2.1828746	.4581115	23.6574918	10.8377695
17	2.2920183	.4362967	25.8403664	11.2740662
18	2.4066192	.4155207	28.1323847	11.6895869
19	2.5269502	.3957340	30.5390039	12.0853208
20	2.6532977	.3768895	33.0659541	12.4622103
21	2.7859626	.3589424	35.7192518	12.8211527
22	2.9252607	.3418499	38.5052144	13.1630026
23	3.0715238	.3255713	41.430475 1	13.4885739
24	3.2251000	.3100679	44.5019989	13.7986418
25	3.3863549	.2953028	47.7270988	14.0939445
26	3.5556727	.2812407	51.1134537	14.3751853
27	3.7334563	.2678483	54.6691264	14.6430336
28	3.9201291	.2550936	58.4025827	14.8981272
29	4.1161356	.2429463	62.3227119	15.1410735
30	4.3219424	.2313774	66.4388474	15.3724510
31	4.5380395	.2203595	70.7607898	15.5928104

COMPOUND INTEREST *at 5 per Cent.*

Years.	TABLE IX. Continu'd. *The Amount of* l. 1.	TABLE X. Continu'd. *The present Worth of* l. 1.	TABLE XI. Continu'd. *The Amount of* l. 1 *Annuity.*	TABLE XII. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	4.7649415	.2098662	75.2988293	15.8026766
33	5.0031885	.1998725	80.0637708	16.0025491
34	5.2533480	.1903548	85.0669593	16.1929039
35	5.5160154	.1812903	90.3203073	16.3741942
36	5.7918161	.1726574	95.8363226	16.5468516
37	6.0814069	.1644356	101.6281387	16.7112872
38	6.3854773	.1566054	107.7095457	16.8678926
39	6.7047511	.1491480	114.0950229	17.0170406
40	7.0399887	.1420457	120.7997741	17.1590862
41	7.3919881	.1352816	127.8397628	17.2943678
42	7.7615875	.1288396	135.2317509	17.4232074
43	8.1496669	.1227044	142.9933385	17.5459118
44	8.5571503	.1168613	151.1430054	17.6627732
45	8.9850078	.1112965	159.7001556	17.7740697
46	9.4342582	.1059967	168.6851634	17.8800663
47	9.9059711	.1009492	178.1194216	17.9810155
48	10.4012696	.0961421	188.0253927	18.0771576
49	10.9213331	.0915639	198.4266623	18.1687215
50	11.4674000	.0872037	209.3479954	18.2559253
51	12.0407698	.0830512	220.8153952	18.3389764
52	12.6428082	.0790963	232.8561649	18.4180728
53	13.2749486	.0753298	245.4989731	18.4934026
54	13.9386961	.0717427	258.7739218	18.5651453
55	14.6356309	.0683264	272.7126179	18.6334720
56	15.3674124	.0650727	287.3482488	18.6985444
57	16.1357831	.0619740	302.7156612	18.7605185
58	16.9425722	.0590229	318.8514442	18.8195414
59	17.7897008	.0562123	335.7940164	18.8757536
60	18.6791858	.0535355	353.5837172	18.9292882
61	19.6131451	.0509862	372.2629031	18.9802743

COMPOUND INTEREST *at 6 per Cent.*

Years.	TAB. XIII. *The Amount of* l. 1.	TAB. XIV. *The present Worth of* l. 1.	TABLE XV. *The Amount of* l. 1 *Annuity.*	TABLE XVI. *The present Worth of* l. 1 *Annuity.*
1	1.06	.9433962	1.0	.9433962
2	1.1236	.8899964	2.06	1.8333926
3	1.191016	.8396193	3.1836	2.6730119
4	1.2624769	.7920937	4.3746016	3.4651056
5	1.3382256	.7472582	5.6370930	4.2123638
6	1.4185191	.7049605	6.9753187	4.9173244
7	1.5036303	.6650571	8.3938378	5.5823815
8	1.5938481	.6274124	9.8974681	6.2097939
9	1.6894790	.5918985	11.4913162	6.8016923
10	1.7908477	.5583948	13.1807958	7.3600871
11	1.8982980	.5267875	14.9716435	7.8868747
12	2.0121965	.4969694	16.8699420	8.3838440
13	2.1329283	.4688390	18.8821385	8.8526831
14	2.2609039	.4423010	21.0150667	9.2949840
15	2.3965582	.4172651	23.2759707	9.7122491
16	2.5402517	.3936463	25.6725289	10.1058953
17	2.6927728	.3713644	28.2128806	10.4772597
18	2.8543392	.3503438	30.9056534	10.8276035
19	3.0255995	.3305130	33.7599925	11.1581165
20	3.2071355	.3118047	36.7855920	11.4699213
21	3.3995636	.2941554	39.9927275	11.7640767
22	3.6035374	.2775051	43.3922911	12.0415818
23	3.8197497	.2617973	46.9958285	12.3033790
24	4.0489346	.2469786	50.8155782	12.5503576
25	4.2918707	.2329986	54.8645128	12.7833562
26	4.5493829	.2198100	59.1563835	13.0031663
27	4.8223459	.2073680	63.7057664	13.2105342
28	5.1116866	.1956301	68.5281123	13.4061644
29	5.4183878	.1845567	73.6397990	13.5907211
30	5.7434911	.1741101	79.0581868	13.7648312
31	6.0881006	.1642548	84.8016779	13.9290861

COMPOUND INTEREST *at* 6 *per Cent.*

Years.	TAB. XIII. Continu'd. *The Amount of* l. 1.	TAB. XIV. Continu'd. *The present Worth of* l. 1.	TABLE XV. Continu'd. *The Amount of* l. 1 *Annuity.*	TABLE XVI. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	6.4533866	.1549574	90.8897785	14.0840435
33	6.8405898	.1461862	97.3431652	14.2302297
34	7.2510252	.1379115	104.1837550	14.3681412
35	7.6860867	.1301052	111.4347802	14.4982465
36	8.1472519	.1227407	119.1208669	14.6209872
37	8.6360870	.1157932	127.2681188	14.7367804
38	9.1542523	.1092388	135.9042059	14.8460192
39	9.7035074	.1030555	145.0584581	14.9490747
40	10.2857178	.0972222	154.7619655	15.0462969
41	10.9028609	.0917190	165.0476833	15.1380160
42	11.5570326	.0865274	175.9505442	15.2245434
43	12.2504545	.0816296	187.5075769	15.3061730
44	12.9854818	.0770091	199.7580314	15.3831821
45	13.7646107	.0726500	212.7435132	15.4558321
46	14.5904873	.0685378	226.5081239	15.5243699
47	15.4659166	.0646583	241.0986112	15.5890282
48	16.3938716	.0609984	256.5645278	15.6500266
49	17.3775039	.0575457	272.9583994	15.7075723
50	18.4201541	.0542884	290.3359032	15.7618610
51	19.5253634	.0512154	308.7560573	15.8130761
52	20.6968852	.0483164	328.2814207	15.8613925
53	21.9386983	.0455816	348.9783059	15.9069741
54	23.2550202	.0430015	370.9170041	15.9499760
55	24.6503214	.0405674	394.1720243	15.9905430
56	26.1293406	.0382712	418.8223456	16.0288141
57	27.6971011	.0361049	444.9516863	16.0649190
58	29.3589272	.0340612	472.6487874	16.0989802
59	31.1204628	.0321332	502.0077145	16.1311134
60	32.9876905	.0303143	533.1281773	16.1614277
61	34.9669520	.0285984	566.1158679	16.1900261

COMPOUND INTEREST *at* 8 *per Cent.*

Years.	TABLE XVII. *The Amount of* l. 1.	TAB. XVIII. *The preſent Worth of* l. 1.	TABLE XIX. *The Amount of* l. 1 *Annuity.*	TABLE XX. *The preſent Worth of* l. 1 *Annuity.*
1	1.08	.9259259	1.0	.9259259
2	1.1664	.8573388	2.08	1.7832648
3	1.259712	.7938224	3.2464	2.5770979
4	1.3604890	.7350299	4.506112	3.3121268
5	1.4693281	.6805832	5.866010	3.9927100
6	1.5868743	.6301696	7.3359290	4.6228797
7	1.7138243	.5834904	8.9228034	5.2063701
8	1.8509302	.5402689	10.6366276	5.7466389
9	1.9990046	.5002490	12.4875579	6.2468879
10	2.1589250	.4631935	14.4865626	6.7100814
11	2.3316390	.4288829	16.6454876	7.1389643
12	2.5181701	.3971138	18.9771266	7.5360780
13	2.7196237	.3676979	21.4952967	7.9037759
14	2.9371936	.3404610	24.2149204	8.2442370
15	3.1721691	.3152417	27.1521140	8.5594790
16	3.4259426	.2918905	30.3242831	8 8513691
17	3.7000181	.2702689	33.7502258	9.1216381
18	3.9960195	.2502490	37.4502438	9.3718871
19	4.3157011	.2317121	41.4462633	9.6035992
20	4.6609571	.2145482	45.7619644	9.8181474
21	5.0338337	.1986557	50.4229215	10.0168031
22	5.4365404	.1839405	55.4567552	10.2007436
23	5.8714636	.1703153	60.8932956	10.3710589
24	6.3411827	.1576993	66.7647593	10.5287582
25	6.8484752	.1460179	73 1059400	10.6747761
26	7.3963532	.1352018	79.9544152	10.8099779
27	7 9880615	.1251868	87.3507684	10.9351647
28	8.6271064	.1159137	95.3388299	11.0510784
29	9.3172749	.1073275	103.9659363	11.1584059
30	10.0626569	.0993773	113.2832112	11.2577833
31	10.8676694	.0920160	123.3458680	11.3497993

COMPOUND INTEREST *at* 8 *per Cent.*

Years.	TABLE XVII. Continu'd. *The Amount of* l. 1.	TAB. XVIII Continu'd. *The present Worth of* l. 1.	TABLE XIX. Continu'd. *The Amount of* l. 1 *Annuity.*	TABLE XX. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	11.7370830	.0852000	134.2135375	11.4349993
33	12.6760496	.0788889	145.9506205	11.5138883
34	13.6901336	.0730453	158.6266701	11.5869336
35	14.7853443	.0676345	172.3168037	11.6545681
36	15.9681718	.0626246	187.1021480	11.7171927
37	17.2456255	.0579857	203.0703198	11.7751784
38	18.6252756	.0536905	220.3159454	11.8288689
39	20.1152976	.0497134	238.9412209	11.8785823
40	21.7245214	.0460309	259.0565186	11.9246132
41	23.4624832	.0426212	280.7810400	11.9672344
42	25.3394818	.0394641	304.2435232	12.0066985
43	27.3666404	.0365408	329.5830050	12.0432394
44	29.5559716	.0338341	356.9496454	12.0770735
45	31.9204493	.0313279	386.5056169	12.1084014
46	34.4740853	.0290073	418.4260663	12.1374087
47	37.2320121	.0268586	452.9001515	12.1642673
48	40.2105730	.0248691	490.1321636	12.1891363
49	43.4274189	.0230269	530.3427367	12.2121633
50	46.9016124	.0213212	573.7701556	12.2334845
51	50.6537414	.0197419	620.6717680	12.2532264
52	54.7060407	.0182795	671.3255094	12.2715059
53	59.0825240	.0169255	726.0315501	12.2884314
54	63.8091259	.0156717	785.1140741	12.3041031
55	68.9138560	.0145109	848.9232000	12.3186140
56	74.4269644	.0134360	917.8370559	12.3320500
57	80.3811216	.0124408	992.2640203	12.3444908
58	86.8116113	.0115192	1072.6451419	12.3560100
59	93.7565402	.0106660	1159.4567532	12.3666760
60	101.2570634	.0098759	1253.2132934	12.3765518
61	109.3576285	.0091443	1354.4703569	12.3856962

COMPOUND INTEREST *at* 10 *per Cent.*

Years.	TABLE XXI. *The Amount of* l. 1.	TAB. XXII. *The preſent Worth of* l. 1.	TAB. XXIII. *The Amount of* l. 1 *Annuity.*	TAB. XXIV. *The preſent Worth of* l. 1 *Annuity.*
1	1.1	.9090909	1.	.9090909
2	1.21	.8264463	2.1	1.7355372
3	1.331	.7513148	3.31	2.4868520
4	1.4641	.6830135	4.641	3.1698654
5	1.61051	.6209213	6.1051	3.7907868
6	1.771561	.5644739	7.71561	4.3552607
7	1.9487171	.5131581	9.487171	4.8684188
8	2.1435888	.4665074	11.435888	5.3349262
9	2.3579477	.4240976	13.5794769	5.7590238
10	2.5937425	.3855433	15.9374246	6.1445671
11	2.8531167	.3504939	18.5311671	6.4950610
12	3.1384284	.3186308	21.3842838	6.8136918
13	3.4522712	.2896644	24.5227121	7.1033562
14	3.7974983	.2633313	27.9749834	7.3666875
15	4.1772482	.2393920	31.7724817	7.6060795
16	4.5949730	.2176291	35.9497299	7.8237086
17	5.0544703	.1978446	40.5447028	8.0215533
18	5.5599173	.1798588	45.5991731	8.2014121
19	6.1159090	.1635080	51.1590904	8.3649201
20	6.7274999	.1486436	57.2749995	8.5135637
21	7.4002499	.1351306	64.0024994	8.6486943
22	8.1402749	.1228460	71.4027494	8.7715403
23	8.9543024	.1116782	79.5430243	8.8832184
24	9.8497327	.1015256	88.4973268	8.9847440
25	10.8347059	.0922960	98.3470594	9.0770400
26	11.9181765	.0839055	109 1817654	9.1609455
27	13.1099942	.0762777	121.0999419	9 2372232
28	14.4209936	.0693433	134.2099361	9.3065665
29	15.8630930	.0630394	148.6409297	9.3696059
30	17.4494023	.0573086	164 4940227	9.4269145
31	19.1943425	.0520987	181.9434250	9.4790132

COMPOUND INTEREST *at* 10 *per Cent.*

Years.	TAB. XXI. Continu'd. *The Amount of* l. 1.	TAB. XXII. Continu'd. *The present Worth of* l. 1.	TAB. XXIII. Continu'd. *The Amount of* l. 1 *Annuity.*	TAB. XXIV. Continu'd. *The present Worth of* l. 1 *Annuity.*
32	21.1137767	.0473624	201.1377674	9.5263756
33	23.2251544	.0430568	222.2515442	9.5694324
34	25.5476699	.0391425	245.4766986	9.6085749
35	28.1024368	.0355841	271.0243685	9.6441590
36	30.9126805	.0323492	299.1268053	9.6765082
37	34.0039486	.0294083	330.0394858	9.7059165
38	37.4043434	.0267349	364.0434344	9.7326514
39	41.1447778	.0243044	401.4477779	9.7569558
40	45.2592556	.0220949	442.5925557	9.7790507
41	49.7851811	.0200863	487.8518112	9.7991370
42	54.7636992	.0182603	537.6369924	9.8173973
43	60.2400692	.0166002	592.4006916	9.8339975
44	66.2640761	.0150911	652.6407608	9.8490887
45	72.8904837	.0137192	718.9048368	9.8628079
46	80.1795321	.0124720	791.7953205	9.8752799
47	88.1974853	.0113382	871.9748526	9.8866181
48	97.0172338	.0103074	960.1723378	9.8969255
49	106.7189572	.0093704	1057.1895716	9.9062959
50	117.3908529	.0085186	1163.9085288	9.9148145
51	129.1299382	.0077441	1281.2993810	9.9225586
52	142.0429320	.0070401	1410.4293198	9.9295987
53	156.2472252	.0064001	1552.4722518	9.9359989
54	171.8719477	.0058183	1708.7194769	9.9418171
55	189.0591425	.0052893	1880.5914247	9.9471065
56	207.9650567	.0048085	2069.6505671	9.9519150
57	228.7615624	.0043714	2277.6156238	9.9562864
58	251.6377186	.0039740	2506.3771862	9.9602603
59	276.8014905	.0036127	2758.0149048	9.9638730
60	304.4816395	.0032843	3034.8163953	9.9671573
61	334.9298035	.0029857	3339.2980349	9.9701430